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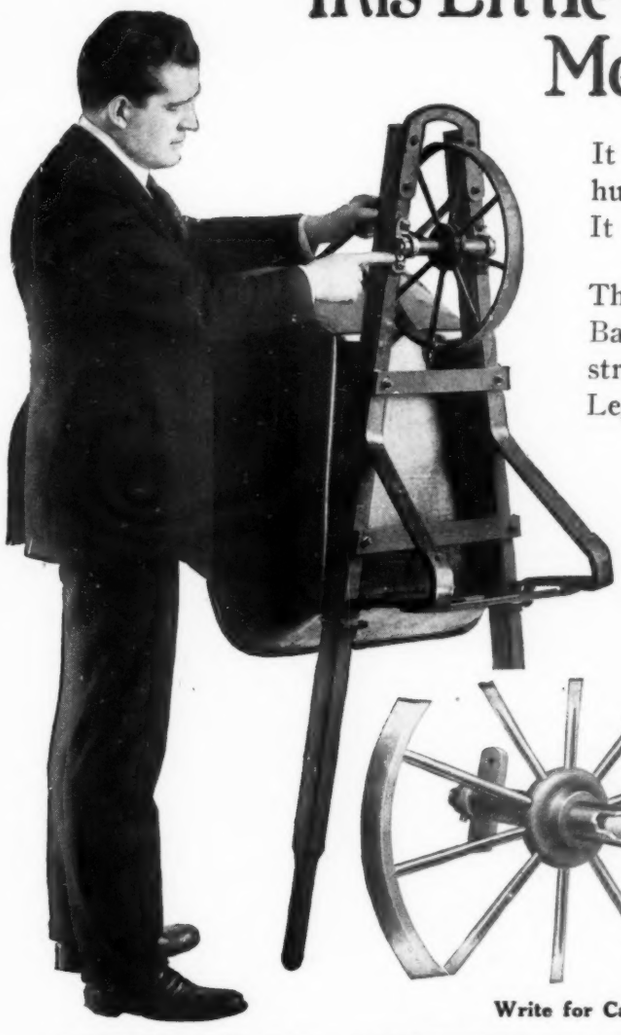

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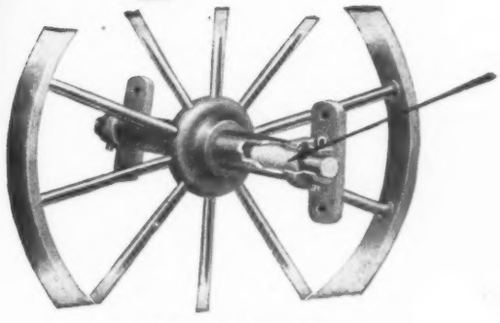

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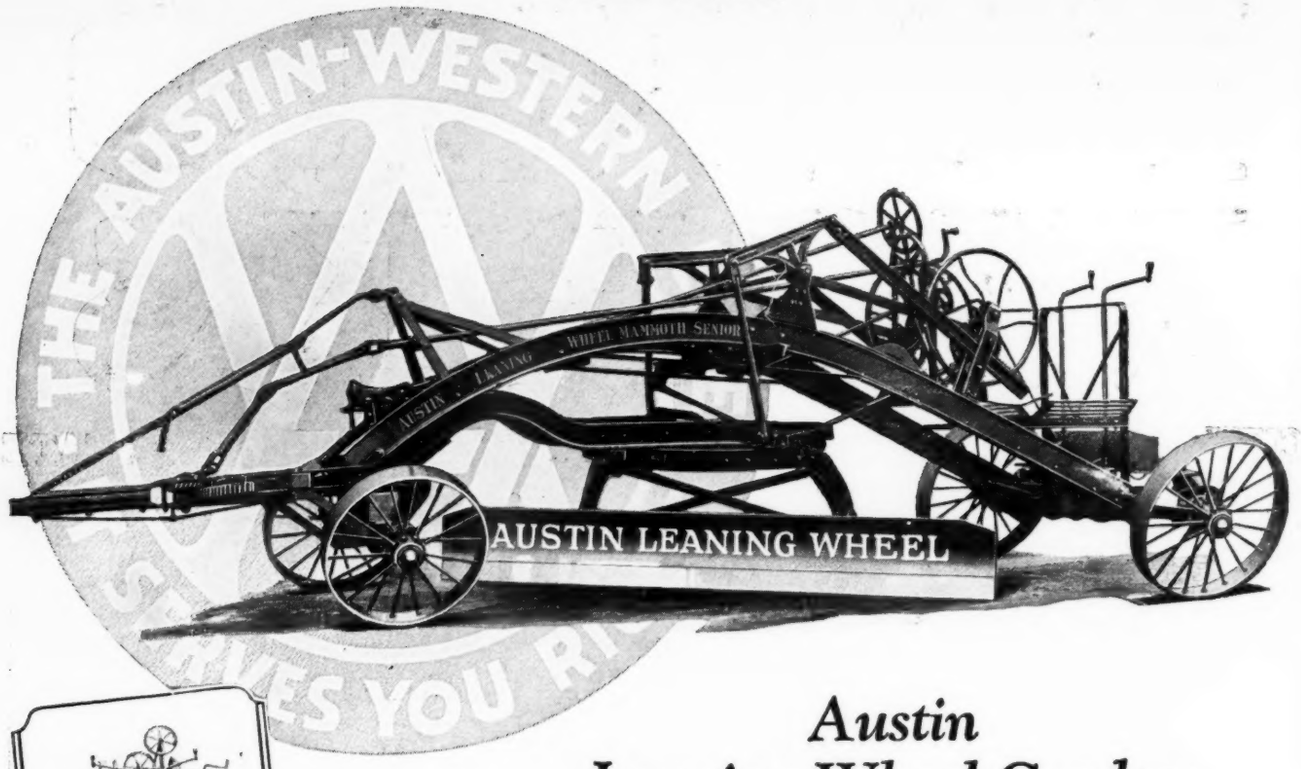

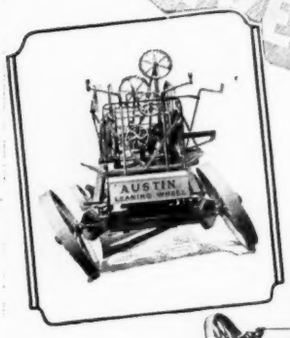

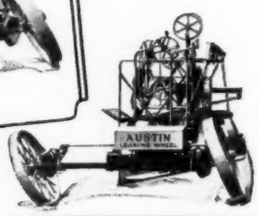

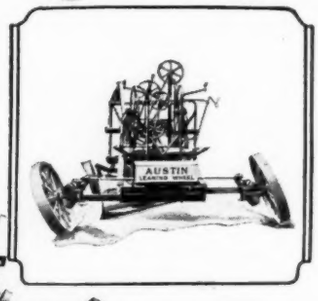

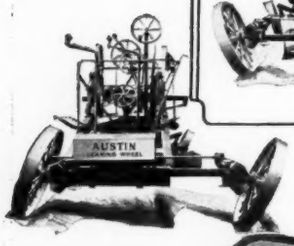

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VOL. 55 NO. 10

Entered as second-class matter at the Post Office, at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879.
Published monthly by **PUBLIC WORKS JOURNAL CORPORATION**, 243 West 39th Street, New York, N. Y.
Subscription price $3.00 a year, single copies 25 cents.
OCTOBER, 1924

PUBLIC WORK
CITY COUNTY STATE
A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 55 October, 1924 No. 10

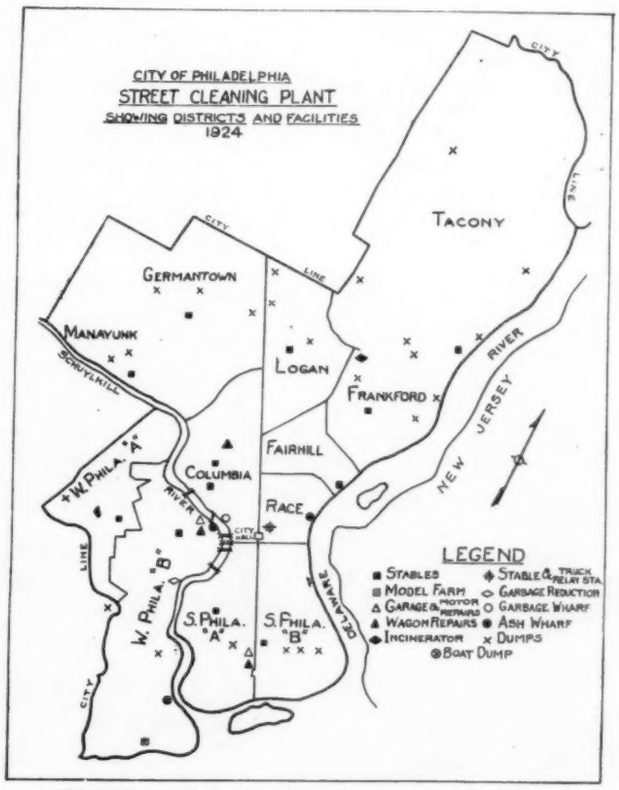
Municipal Street Cleaning in Philadelphia*

By Charles A. Howland†

For many years prior to 1921, street cleaning and the collection and disposal of refuse had been done in Philadelphia under contract. Serious difficulties were encountered in formulating specifications for the irregular operations involved, and the results desired could not be definitely specified. Compliance with the specifications was difficult to obtain. The service under the contract system was unsatisfactory and no means were found to place the work on an efficient basis.

Civic effort was concentrated upon the substitution of municipal operation for contract work, but authority from the state legislature was required to make the change. This authority was obtained in the act of 1919 called the "new city charter." A commission of engineers, appointed by the mayor in 1920, studied the methods employed in other cities and recommended municipal operation. In 1921 municipal work was inaugurated in two of the 13 street-cleaning districts of the city and, in 1922, was extended to the whole city.

In Philadelphia, the highway work of the city is done by the Bureau of Highways of the Department of Public Works, under the direction of the bureau chief. Construction and maintenance of highway is handled by a division of highways, headed by a deputy chief under whom are six district engineers. Street cleaning and the collection and disposal of refuse comprise the work of a division of street cleaning in charge of a second deputy chief.



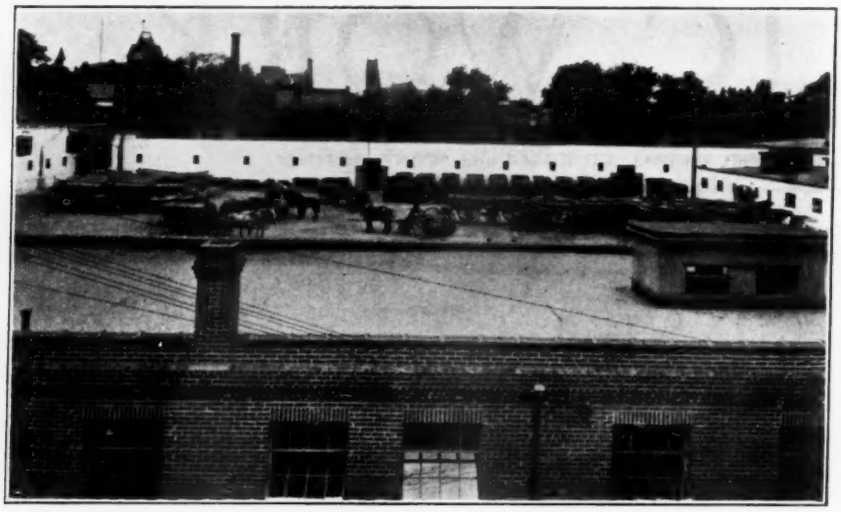
STREET CLEANING DISTRICTS AND LOCATIONS OF STRUCTURES, DUMPS, ETC.

The city area of 129.7 square miles was divided, in 1922, into 12 street-cleaning districts, each of which was placed in charge of a superintendent. Subsequently the number was reduced to 10, laid out as shown on the accompanying map. The population served numbers over 1,900,000, consisting of over 400,000 families, who live in over 352,000 dwellings, on 1,800 miles of streets and roads, 1,650 of which are paved, many so poorly as to be difficult to clean. There are also 210 miles of alleys only 3 or 4 feet wide.

In the beginning, the policy was inaugurated of placing special activities, such as the operation of shops, care of motor

*A review of a report of the Bureau of Municipal Research of Philadelphia. Some of the most recent information, which could not be included in the report, is incorporated in the review. These later data were supplied by Mr. Archer M. Soby, who is deputy chief of the bureau of highways, in charge of the street cleaning division, and Mr. John H. Nuttall, who is his principal assistant. Copies of the report may be obtained, free of charge, from the Bureau at 905 Social Service Building, 311 S. Juniper St., Philadelphia.

†Staff Engineer of the Bureau of Municipal Research of Philadelphia.



VIEW OF A CITY STABLE.

equipment, care of horses, operation of garbage-reduction plant, operation of incinerator, and keeping of accounts, in charge of separate superintendents. This policy is still followed. Under the superintendents are foremen in charge of street cleaning, ash and rubbish collection, garbage collection, dumps, and stables; and sub-foremen supervise the sub-divisions of these activities. With its quota of drivers, helpers, blockmen, mechanics, etc., the Division of Street Cleaning employs a total of approximately 3,000 persons.

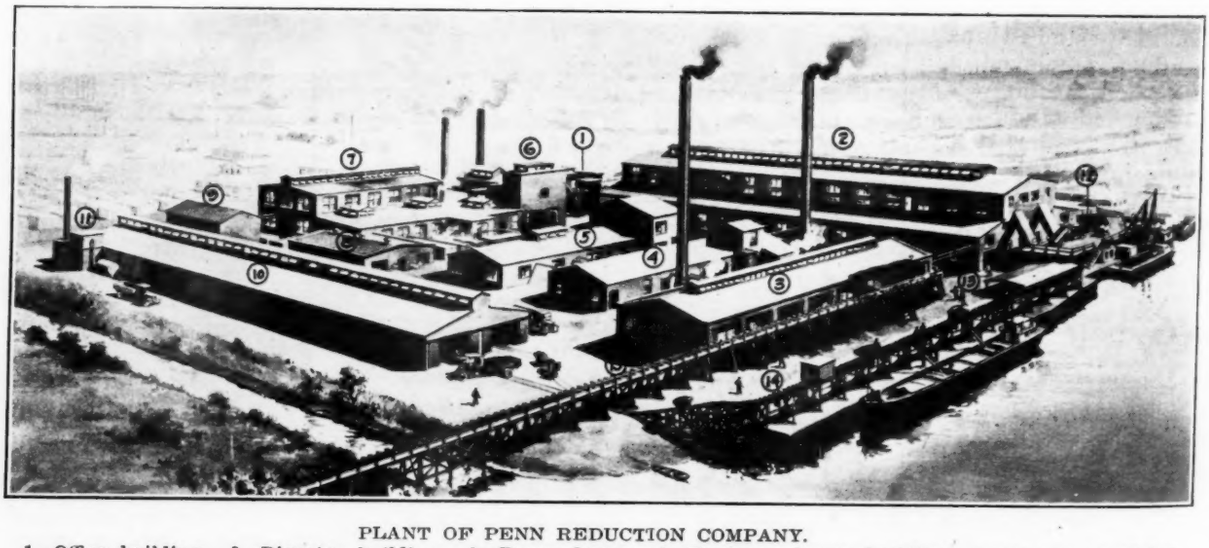
Motor vehicles are repaired and stored at two large garages, one of which is equipped to make major repairs, while minor repairs are made at the other. Three smaller garages are used for storage in the district. When necessary, other garages are rented to provide storage near the work. Wooden wagons are repaired at two shops provided for that purpose, and maintenance work on iron-body wagons is done at a third shop. The shop equipment is adequate to manufacture wooden wagons, 50 wagons having been made in 1922 and about 45 in 1923.

From a large, central storehouse an organized motor-car service delivers supplies to storehouses in the separate districts. Thirteen stables are maintained for the horses, at present numbering about 1,650. Two of the stables, which have capacities of 270 and 230 horses respectively, have been built by the city. Practically all of the property occupied is rented. As extensive improvements to it have been necessary, the question has arisen whether the city should not own all of the land and buildings which it uses. Veterinarians make routine examinations of draft animals. At a city-owned farm good facilities are available for veterinary treatment of horses and for conditioning them. The locations of shops, stables, and other facilities are shown on the map.

A part of the equipment needed for the work was bought from the contractors who had formerly performed it. In all 2,295 pieces of equipment, such as flushers, wagons, trucks, and machine brooms, were purchased at a cost of $891,411.18; and of these, 856 pieces were second hand. Very little equipment has been rented by the city.

CLEANING METHODS EMPLOYED

A number of difficulties, arising chiefly from pavement construction, are encountered in cleaning the streets of Philadelphia. Much granite-block pavement, originally laid on a gravel foundation, still remains, and this, with the older, uneven asphalt pavements, is not easily cleaned. The variations in kind of street surface and quantities of dirt encountered require different methods in the several districts and even in parts of



PLANT OF PENN REDUCTION COMPANY.

1—Office building. 2—Digester building. 3—Power house. 4—Engine and store building. 5—Grease. 6—Drier building. 7—Percolater building. 8—Tank building. 9—Screen building. 10—Storage building. 11—Dust building. 12—Garbage dump building. 13—Wharf. 14—Industrial railway. 15—Coal siding.

the same district. A total pavement area of nearly 25,000,000 square yards is to be cleaned. From this area the volume of street dirt removed was 504,246 cubic yards in 1922 and 476,372 cubic yards in 1923.

Where the percentage of rough-surface streets is high, the 2-horse machine broom, supplemented in the central areas of the city by blockmen, is used. On streets in the center of the city with smooth surfaces, night flushing by machine flushers is employed; and flushers, accompanied by gangs, clean smooth streets in outlying areas. The present tendency is away from the use of the patrol or blockman system in streets without congested traffic because of the difficulties of supervision and the low quality of labor available for this work. Flushing, machine-brooms, and hand-broom gangs are being substituted for blockmen. Curb collection of ashes and rubbish makes it necessary to clean the streets immediately after the collection, and considerable attention has been given to balancing ash collection routes and street cleaning routes.

Paved alleys, the large majority of which are too narrow for vehicular traffic, are cleaned by men working with the machine-broom and flusher gangs.

Catch basins on storm water inlets, unless choked in the neck, are cleaned by the division of street cleaning. These basins are cleaned by men working with the regular gangs or by special units of three or five men who take out the dirt with drags and deposit it in iron-body wagons. Mechanical equipment has not been used for catch basin cleaning.

TYPICAL PHILADELPHIA ALLEY.

REFUSE COLLECTION

The collection of ashes and rubbish is an important part of the work of the division of street cleaning. Weekly collections of mixed ashes and rubbish are made throughout the greater part of the city. A limit of 400 pounds is placed upon the amount of mixed ashes and rubbish which will be removed from each residence and from each apartment of an apartment house. Receptacles must be placed at the street curb for collection.

In general, two-horse, rear-dump wagons are used where the round trip is not more than 5 miles; while for hauls greater than this, motor trucks are employed for curb collection or for hauling from relay stations. The wagons have a capacity of 4 cubic yards, which can be increased to 6 cubic yards by the use of detachable sides and it is the practice to over-load an additional 2 cubic yards in the summer. Trucks with body capacities of from 6 to 17½ cubic yards are used. Only one truck of the latter capacity is in service and this is often over-loaded to carry as much as 25 cubic yards. One helper to two wagons and two helpers to each truck are the ratios maintained as far as practicable.

Although some progress has been made, the adjustment of collection routes to available dumps and to stable locations, to give the most economical work schedules, has been handicapped by the necessity for street cleaning immediately after ash and rubbish collection and by the lack of technical men to make the studies. During 1922 a total of 1,795,557 cubic yards of ashes and rubbish were collected and in 1923 the total was 1,844,162 cubic yards.

STREET BEFORE REMOVAL OF REFUSE.

Garbage is collected three times each week in all sections of the city except during the period from July 1 to October 1, when it is collected six times each week in the central section of the city. It is required that garbage be placed for collection at the street curb, at the curb in a rear or side alley, or at a point on the property visible from the street. Containers must be of metal of not over 5 cubic feet capacity and the garbage not be mixed with other material. Wagons with all-metal, rear-dump bodies of

MACHINE BROOM GANG—HORSE-DRAWN.

ASH WAGONS BEING LOADED, SHOWING DETACHABLE SIDES.

3½ cubic yards capacity are used in collecting and it is the practice for the driver to lift the garbage. Private garbage collectors also operate to some extent in Philadelphia. It is estimated that 34,026 tons of garbage were collected by private collectors out of the total of 233,715 tons collected in 1923, the remainder having been collected by city forces. The figures for the total garbage produced in the city give about 246.02 pounds of garbage per capita per year or 0.674 pounds per capita per day.

Previously collections were made over individual routes but it was found to be difficult to supervise the large number of small areas. This system is being replaced by the use of fleets of wagons, sometimes as many as 12 in number, under the direct control of a foreman. Each wagon collects on a designated street and is assigned to help other wagons when the initial street is completed.

The collection service is handicapped in Philadelphia by the absence of alleys in some sections, and by the narrow alleys in others. Collection from both sides of the street is necessary where the garbage is placed at the curb, or numerous trips must be made into the alleys when these are only three or four feet wide, which are the usual widths.

DISPOSAL OF REFUSE

The problem of disposing of the collected refuse has not been easy of solution. Ashes, rubbish, and street dirt are disposed of principally upon land dumps, and to obtain adequate dumps at a reasonable distance from built-up sections is increasingly difficult. The city has sometimes been required to pay a rental for the privilege of dumping, and this has suggested that areas should be purchased for this purpose.

Transportation of refuse by water to ultimate points of disposal has been used. Two municipal dumping wharves were built to deliver to barges the ashes and rubbish collected in the central areas of the city. Garbage is also transported to a reduction plant by barges from a dumping wharf on the Schuylkill river. Near the plant, wagons deliver direct, while for hauling from more distant sections, two relay stations, where the wagons dump into trucks, are used. Water transportation of refuse is done under contract on a tonnage basis measured by displacement.

The greater part of the garbage is treated at the reduction plant. This plant, which was built by a private company in 1906, was purchased by the city in 1921. The garbage is cooked by steam under pressure, and is then pressed to separate the water and grease. The solid residue is treated with naphtha for the extraction of additional grease and is then dried and screened. Although the capacity of the plant is placed at 520 tons per day of 12 hours, the plant has handled much more for short periods.

Last year, 112,968 tons of garbage were reduced at the plant and from this 6,083,910 pounds of grease, and 12,310.5 tons of tankage were obtained. During the first three months of 1923, a price of $4.27 per ton was received for tankage while the price for the remainder of the year was $5.50 per ton. In June, 1924, the price of grease was $0.055 per pound and the price for tankage was $3.26 per ton. For 1923, the computations of the division of street cleaning give the cost of reduction as $2.728 per ton and the value of the products as $3.451, which shows a profit of $0.723 per ton of garbage reduced.

(To be continued)

Garbage Collection in Providence

In November, 1921, the collection of garbage in the city of Providence, R. I., was begun under a 6-year contract, the city to pay a private contractor $80,000 a year for the service. In his report for 1923, Charles V. Chapin, superintendent of health, states that during that year the collection was exceedingly unsatisfactory; 2,321 complaints were received and the number would have been much greater, but the people become so discouraged that they ceased making complaints. Department inspectors found that collections were made very irregularly, generally only twice a week instead of three times as required by the contract, while in some places they were entirely neglected for a week or more at a time. Although the contractor was called upon to improve the service, he did not do so. Even when called before the Mayor and shown a definite statement of his derelictions, when he agreed to carry out the contract to the letter, little improvement resulted and toward the end of 1923 he gave up the contract and it was taken over by the Rhode Island Livestock Company.

Refuse Disposal in Milwaukee

Collection of wrapped garbage, ashes and rubbish satisfactory. Thirteen years' service of the incinerator proves desirability of designing of incinerators by engineers.

As a part of a paper before the American Society for Municipal Improvements on "Collection and Disposal of Garbage and Ashes," T. Chalkley Hatton described the operation and results obtained by the Milwaukee garbage disposal plant, which has been in continuous operation for thirteen years. The part of this paper dealing with this plant and with the collection of garbage and other refuse was as follows:

The method of collecting refuse in practice in Milwaukee gives very satisfactory service, is sanitary and costs more, but so far the author has heard no serious complaints in the ten years he has been a resident. The garbage is all wrapped in papers and deposited in closed cans at the rear of the houses and the collectors take it from these cans. The wrapping of garbage reduces the nuisance arising from decomposition and facilitates its collection without offense to the collector or neighborhood.

The refuse and ashes are deposited in either receptacles or bins in the cellars of the houses which, when filled, are emptied by the collectors going into the cellars, taking the ashes out through the nearest window or door and carrying it in pans provided to the trailer in the street. The householder is thus saved the trouble of wrestling weekly with a barrel or can of ashes up the back stairs, getting his clothes dirty and his disposition spoiled, and this alone is worth the extra cost to most householders. There is no refuse blowing over the neighborhood on ash day as is the case in so many cities.

Milwaukee's garbage disposal plant may not be as efficient as the more recent plants, but it has the unique record of being operated continuously for 13 years at rates equal to the original estimates and without offense, although it has received the minimum of appropriations from the city fathers. The answer is that it was designed by a competent engineer, the late Dr. Hering; its construction supervised by another competent engineer, Samuel Greeley, and its operation directed by a deputy commissioner, Chas. Davis, a civil service appointee, who has held office for a number of years with great credit to himself and to the advantage of the city.

Milwaukee incinerates its garbage by means of four Heenan and Froude furnaces, each guaranteed to consume 75 tons of mixed garbage and refuse per 24 hours, 60% to be garbage and 40% to be combustible refuse. The plant is equipped with four 200 h.p. water tube boilers which generate sufficient steam from the furnace heat to operate a turbo-generator of 600 k.w. capacity.

The heat from the burning of one ton of mixed garbage produces 50 k.w. electric power which is used to operate the motors about the plant, to drive low-lift flushing pumps operated by the city and the balance sold to the Electric Power Co. Its value to the city, based upon the price the company charges for like service, is one cent per k.w.hr.

In the thirteen years' operation this plant has handled 500,000 tons of mixed garbage at an average cost of $2.44 per ton, excluding overheads and excluding value of electric current produced. From 1911 to 1916, the gross cost per ton of garbage was from $1.60 to $1.78. From 1917 to 1924, the cost was from $2.35 to $4.12, the additinal cost being largely represented by extra cost of wages.

The plant was completely overhauled in 1923, since which the gross cost per ton of mixed refuse burned has been $2.44, net $1.94, excluding overheads.

In all public service of this kind, efficiencies introduced are so frequently nullified by irregularity of service. Full equipment and plant help must be maintained throughout the year to meet the requirements of peak loads. This feature is so frequently overlooked when costs of operating such a plant are estimated. For instance, the service required by the Milwaukee plant has varied from a minimum load of 206 tons per week to 1,261 tons per week.

The method of collecting both garbage and ashes was completely changed in 1923 under the direction of Roland E. Stoelting, Commissioner of Public Works, a civil engineer. Prior to the change, the garbage had been collected by hired teams and drivers hauling the garbage by single loads for an average of 3½ miles to the plant. The city provided 203 trailers and 20 trucks used for the collection of both ashes and garbage.

The trucks haul a train of four trailers each trip. They spot the empties, each at a certain point, from which it is moved by horse throughout the area and returned, filled, to the collection point at a certain specified time, when the truck picks it up and hauls it to the incinerator.

For the first six months of 1923 there were collected by wagons 19,807 tons at a cost of $105,672, or $5.38 per ton. The last six months there were collected by trucks and trailers 17,066 tons at a total cost of $77,689.90, or $4.52 per ton. During the first eight months of 1924 the cost by trucks and trailers has been reduced to $4.34 per ton.

The city has a population of approximately 500,000 and in 1922 and 1923 collected 47,060 and 47,297 tons, respectively, of garbage, or about 188 lbs. per year per capita. It burned in 1923, 49,866 tons, the difference being represented by mixed garbage delivered to the incinerator by private parties.

The service given by the city may be properly measured by the number of complaints received. The maximum number received was in August, 1924, and numbered 1,052, or about one per cent

of householders. Compare this with the percentage of complaints received by quasi-public utilities and you will find the service has been eminently satisfactory.

Before closing this discussion the author wants to give a little data on the collection of ashes by the City of Milwaukee, as the two services are somewhat connected inasmuch as the same equipment and men are used for both. This is possible in our northern climates because the period of peak service in garbage collection comes during the minimum period of service in ash collection, and vice versa.

As previously stated, the collection is made by men employed by the city going into the cellars of the buildings, taking out the ashes and rubbish which has been deposited by the householder in bins or receptacles and emptying it into trailers; the householder having no concern or trouble whatever except to telephone to headquarters that his ash bin is full and should be emptied.

The full trailers are hauled in trains of four to an ash dump, mostly outside the city limits, where the trailers dump the loads in a few minutes and a traction caterpillar with bull-dozer equipment pushes the loads over the edges of the dump, keeping the surface well levelled. These caterpillars do away with the large number of old men usually employed upon ash dumps to keep the dumps level and cut down the expense prodigiously.

In 1923 there were 473,523 cubic yards of ashes collected and placed upon dumps at a total cost, exclusive of overheads, of $484,450, or $1.015 per cubic yard. This cost represents the combined costs of collection by both trailers and wagons, the trailers being introduced during the year, after which the cost per cubic yard was reduced to 81.8 cents.

The maximum collection for any one day was March 1, when 4,003 cubic yards were collected at a cost of $1,778.85, or about 44 cents per cubic yard.

Refuse Disposal Not a Health Matter

In a paper before the American Society of Sanitary Engineering, M. N. Baker read a paper entitled, "Garbage and Refuse Disposal a Matter of Cleansing Rather than Health," in which he not only spoke at some length on this idea, which is not a new one to engineers, but also gave reasons why it should be more generally realized. No waterworks plants and practically no sewerage systems are operated by the health department, and there would certainly therefore, he stated, seem to be no reason why this department should operate the scavenging and cleansing services, which have infinitely less relation to public health.

That the realization of this is important seemed to him to be borne out by several considerations. Most health matters are acted upon by city officials through the emotions, and therefore spasmodically, because the emotions cannot always be kept at a high pitch. Consequently health matters have their ups and downs in city appropriations and attention; and garbage and refuse disposal will suffer similar fluctuations if they are looked upon as health matters. Mr. Baker expressed his belief that one principal reason why disposal plants are abandoned or neglected so soon after being built is that they are built in the name of public health and through arousing sentimental emotions.

Speaking concerning some of the details of handling refuse, he expressed the opinion that no one could prove, in terms of vital statistics and by rules of evidence, that either garbage wrapping or can washing has any effect upon public health. Apparently he could see no reason for not permitting each householder to attend to the cleaning of his own can, allowing this to be regulated by the sensitiveness of the collective family nostrils. Similarly, the place and method of disposing of the garbage as well as of transporting it through the city is one simply of avoiding offense to eye, ear or nose, and, of course, of relative cost.

Buffalo's New Filtration Plant*

Designing and construction of concrete structures. Excavation and materials of construction handled by cableways spanning the entire work. Connections to intake and other tunnels.

By George C. Andrews
CONCRETE CONSTRUCTION

Since practically all of the basins and conduits comprising this plant are below water level, it has been necessary to design the walls to resist hydrostatic pressure from outside when the basins are empty, and under possible conditions when hydrostatic pressure may come from inside, so that practically all of the walls are designed to take pressure from either direction, and in most cases the walls are reinforced on both inside and outside faces.

About 54,000 cubic yards of concrete was used in the work and approximately 4,000 tons of reinforcing steel. The coagulating basin is constructed practically as a monolith, and there are no expansion joints in the walls or the roof. This basin has been exposed to the extremes of temperature of Summer and Winter and there are practically no cracks of any magnitude in the entire structure. The same may be said of the filtered-water reservoir. The only expansion joint which was provided in the entire structure is that between the filtered-water reservoir and the coagulating basin.

The concrete used in the entire structure is composed of one part Portland cement and five parts Niagara river sand and gravel. Continuous tests on the aggregate were carried on during

*Continued from page 274.

the progress of the work and it was found that proportion of sand and gravel in the mixed aggregate were such as to give a very dense concrete. Tests made on samples of this concrete against penetration by water showed that concrete made up of the natural run of gravel was more dense than concrete composed of screened sand and gravel combined in various artificial proportions. These tests consisted of applying hydrostatic pressures to the inside of hollow blocks of concrete and taking daily measurements of the amounts of water leaking through the concrete blocks or absorbed by them. In nearly all cases the amount of leakage and absorption was greater when artificial mixtures of sand and gravel were used.

The walls of the basin and reservoir are designed as reinforced concrete slabs supported at the top and bottom. The roof of the coagulating basin is of flat slab construction supported on columns spaced 20 feet on centers. This roof is designed for 100 pounds live load and 250 pounds of earth cover. In addition to the tension steel in the roof which takes care of the vertical loading, there is provided reaction steel in both directions extending entirely across the roof to resist the loading due to hydrostatic pressure in both directions. This steel may possibly be in excess of the required amount, since there will never be a condition of maximum loading over the entire area and the tension steel would probably absorb much of this stress; but on account of the omission of expansion joints, this excess steel is deemed desirable.

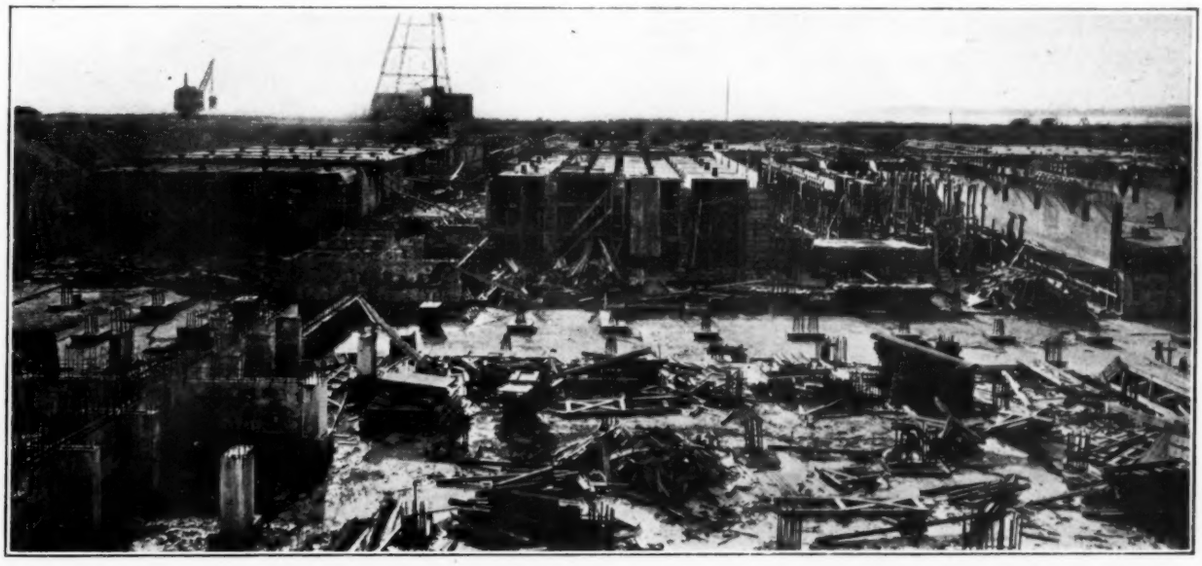
The clear-water reservoir roof was designed to support a maximum loading due to the weight of the filter tanks full of water and in addition 30 inches of gravel in the bottom, or approximately 800 pounds per square foot. This roof is of beam and slab construction and is supported on columns spaced approximately 16 feet on centers. The concrete slab between the beams is 13 inches thick.

EXCAVATION FOR COAGULATING BASIN, LOOKING NORTH. TAKEN JUNE 1, 1923.

The floor of the clear-water reservoir is of concrete and is laid directly on the rock. The underlying rock is of flint and limestone formation and lies in vertical layers 6 inches to 2 feet thick. These layers step down toward the northwest corner and in the lower portions of the reservoir considerable water was encountered. This water was carried off through under-drains, varying in diameter from 6 inches to 12 inches square, to a sump at the lowest corner of the reservoir. This sump will be kept pumped down to a level which will prevent upward pressure on the lower portions of the floor.

THE SUBSTRUCTURE CONTRACT

It was decided to subdivide the work into various contracts which would be advertised as the plans were completed. Plans for the substructures were completed in the Spring of 1922 and bids on the work were opened in July of that year. The Thompson Starrett Company, of New York City, were the successful bidders. The cost of this portion of the work will be approximately two million dollars when completed. It was let on the unit price basis. The main items were as follows: Approximately 380,000 cubic yards of earth excava-



LOOKING WEST FROM ROOF OF COAGULATING BASIN, SHOWING PIPE GALLERY AND FORMS FOR ROOF OF CLEAR-WATER RESERVOIR. TAKEN NOVEMBER 1, 1923

tion. 110,000 cubic yards of earth embankment, 7,000 cubic yards of rock excavation, 110,000 cubic yards of backfill, 54,000 cubic yards of concrete, 4,000 tons of reinforcing steel; and smaller items, such as placing iron pipe castings, laying cast-iron pipe lines, miscellaneous iron and steel work. There was also included a lump sum item for pumping and draining.

Construction work was started in September, 1922. The earth excavation was made chiefly by two 1½-cubic yard drag-line excavators. As a portion of the site for the filtration plant was outside of the existing shore line, excavated material was used as backfill to bring the inundated parts of the site up to grade. This excavation made approximately 15 acres of new land. As the excavation progressed it was necessary to keep the excavated area pumped out so that all the concrete could be placed "in the dry." For the most part the backfill formed a practically watertight cofferdam around the work, with the exception of a portion of the west side which it was necessary to protect with steel sheet piling.

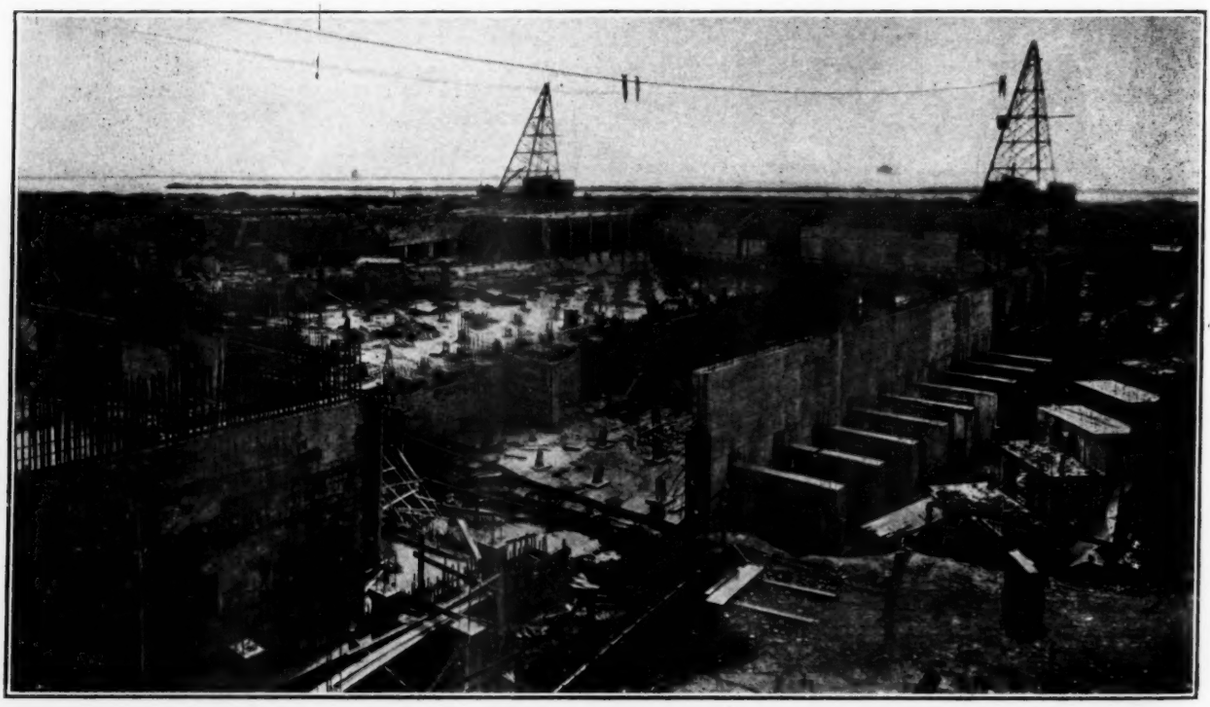
As soon as the excavation had been made to rock on the east side of the work the concrete work was started. The footings for all the walls were placed on top of the rock and were bonded to the rock by steel dowels. These dowels extended into the rock about 18 inches and were grouted. As the rock on the whole presented a rough surface, a very excellent bond between the foundations and the rock was obtained.

The Thompson Starrett Company used large form units for most of the work and these units as well as the concrete were handled by movable steel towers supporting cableways which spanned the entire work from east to west and which were operated on tracks extending over the work in a northerly and southerly direction. The large form units were constructed of 2-inch ship lap nailed to 4-inch x 4-inch timbers and these bolted to 6-inch x 6-inch walers so arranged that they could be bolted together from end to end. These units were 20 feet long and from 10 to 20 feet wide. Steel forms were used for the circular columns in the coagulating basin and the clear water reservoir. The forms for the cover of the coagulating basin and clear-water reservoir were built in place. The scaffolding for these forms was made of 4-inch x 4-inch timbers and cross-braced in both directions.

A single concrete mixing plant was used for the entire work, there being two 1½-yard Smith mixers electrically operated. A bucket conveyor was used for handling the aggregate to bins on top of the mixing plant, from which the aggregate was measured into the hoppers through hand-controlled gates. The cement was handled in bags into these hoppers by elevator from the adjacent cement shed.

The concrete materials were delivered by barges alongside the dock wall adjacent to the mixing plant. Cement was unloaded through hatchways in roof of cement shed. The gravel was unloaded into a large pile under which a wood tunnel was extended from the mixing plant its entire length and a belt conveyor through the tunnel carried the gravel to the bucket conveyor.

After the aggregate and cement had been measured they were discharged into mixers and from these into 5-yard buckets on cars which conveyed the concrete to the cableway conveyors.



LOOKING SOUTHWEST, SHOWING FLOOR AND DIVISION WALL, AND NORTH WALL OF CLEAR-WATER RESERVOIR. PUMP FOUNDATIONS AT THE RIGHT. TAKEN NOVEMBER 1, 1923.

Practically all of the concrete used in the work was deposited by these buckets. The span of the cableways is approximately 700 feet and the steel towers supporting same are 65 feet high. There were practically no delays in the work occasioned by this method of handling the concrete. These cableways, in addition to handling the forms and the concrete, also placed reinforcing steel in large bundles from the stock piles at the locations where it was to be used.

The cars which conveyed the concrete from the mixer to the cableways were operated by gasoline locomotives over narrow-gauge tracks.

CONSTRUCTION OF FILTERED WATER CONDUIT.
Looking from filtered water reservoir toward Ward pumping station.

The concrete walls of the basin and reservoir varied in height from 14 feet to 30 feet and were poured in lifts up to 20 feet high. Where it was impossible to ram the concrete into place the forms were vibrated by air hammers from the outside, and very satisfactory results were obtained by this method.

The forms were tied by bolting through the walls. The bolts passed through iron pipes which extended to within one inch of the face. The pipes were left in the concrete, and after the bolts had been removed the pipes were plugged with wood plugs and the ends covered with concrete which filled the recesses left by iron washers which had held the pipes away from the form face. This method was not entirely satisfactory because in many cases the concrete shrunk away from the sides of the recesses left by the washers.

The conduit connections from the present intake to the filter plant and from the filter plant back to the Ward pumping station are now in process of construction. These are 12-foot-square reinforced concrete tunnels placed on top of the underlying rock, which is from 35 to 40 feet below ground level. They are being constructed in open cuts. The excavation for the raw-water conduit is sheeted with Wakefield sheeting to keep out the water, which on this side of the work flows freely through the ground. As the cableways do not span these conduit connections, the concrete for them is deposited first onto cars and from the cars through chutes to place.

Referring again to the general plant of the work, conduit "A" supplies raw water to the filter plant and conduit "D" returns filtered water to the Ward pumping station. In case of a shutdown of the filter plant, lake water will be bypassed through the present south canal. Double sluice gates 6 feet square will be placed in this bypass. The north canal will be used to carry filtered water to the Massachusetts Avenue pumping station.

To accomplish the connection to the Massachusetts Avenue tunnel it was necessary to make a conduit and shaft connection (shaft No. 4 on plan) between the north canal and the Massachusetts Avenue tunnel and to permanently plug the canal and tunnel to prevent the flow of raw

LOOKING SOUTHEAST, SHOWING FORMS FOR ROOF OF COAGULATING BASIN AND FLOOR AND COLUMN FOOTINGS OF CLEAR-WATER RESERVOIR. TAKEN NOVEMBER 1, 1923.

water in these passages. In case of necessity or when the filter plant is temporarily out of commission, raw water can be furnished to the Massachusetts Avenue station through the old intake in Niagara river opposite that station. Probably the only contingency of this kind which may arise would be the cessation of electric power to the low-lift pumps in the filter plant.

The new circular shaft (No. 4) ten feet in diameter was built under compressed air. A concrete caisson was sunk to the rock level about 30 feet and the rock to the top of Massachusetts Avenue tunnel was excavated under compressed air. The rock section was lined with one foot of concrete and grout was forced into the seams of the rock as the work progressed to prevent leakage. At the present time the shaft is built to the top of the tunnel but the actual connection has not been made. The short length of conduit between the north canal and the shaft is under construction. This is being placed in open cut.

The building of conduit connections to existing canals, the tunnels and shaft No. 4 is being done by the Jarrett-Chambers Company, of New York City. This work will cost, when completed, about $175,000 which, together with the Thompson-Starrett contract, will bring the cost of the substructure work close to two million dollars.

Other contracts which have been let or on which work is under way are as follows: Filter equipment, awarded to the Pitt Construction Company, of Pittsburgh, Pa., for the sum of $216,000; low-lift pumps and switch-boards, awarded to A. J. Abels, of Buffalo, for $67,500; sluice gates and filter valves, awarded to Chapman Valve Company, Michigan Valve Company and Rensselaer Valve Company, aggregating $100,200; cast-iron pipe and special pipe castings, including the filter strainer system, awarded to the U. S. Cast Iron Pipe Company, the Bowler Foundry Company, of Cleveland, Ohio., and the McWane Cast Iron Pipe Company, of Birmingham, Ala., aggregating in cost $192,300.

The contract for the superstructures of the filter plant is being advertised. This is estimated to cost about $400,000, and it is expected its completion in the Fall of 1925 will see all other contracts completed so that by this time next year the city of Buffalo will have filtered water in all of its mains.

The engineering work with respect to the design and construction has been performed by a special engineering force employed by the city and organized and supervised by the writer, Messers C. D. Parsons, J. L. Ames and S. E. Roof being the principal assistants. The firm of Fuller & McClintock, of New York City, was employed as consulting engineers.

Cleaning St. Louis' Filter Sand

During the year 1923 the sand in all of the forty filter beds of the St. Louis Waterwork was cleaned twice by jetting it from one end of the section of a bed to the other. The coating on the grains was found to be 13.2% before jetting the sand and 9.9% immediately afterwards, these being practically the same figures as the previous year.

Decatur's Impounding Reservoir

Effect of new reservoir on operation of filter plant during first twenty-one months. Reduction of turbidity a material benefit.

The city of Decatur, Ill., in the Fall of 1922, completed an impounding dam which formed a reservoir extending approximately thirteen miles upstream and with an estimated storage capacity of approximately six billion gallons, to which it gave the name "Lake Decatur." Previous to this the storage given the water supply was relatively small and probably had little effect on the physical condition of the water, which is obtained from the Sangamon river. A study has been made of the effect of this new impounding reservoir on the operation of the filter plant, and the results of the investigation were described at some length in a paper before the Illinois Section of the American Waterworks Association by William E. Stanley, engineer of Pearse, Greeley & Hansen, and E. E. Ruthrauff, chief operator of the filtration plant.

Records were available showing the turbidity of the river water for a period of six years prior to the construction of the new reservoir and were compared with those for 21 months after the construction of the reservoir.

This comparison showed a very material reduction in the turbidity of the raw water. Without the new reservoir, for about 25% of the time the turbidities were 100 parts per million or greater, and for 5% of the time were 500 parts or greater. Since the use of the reservoir the turbidities for 25% of the time have been 50 parts per million or greater and for 5% of the time 150 parts per million or greater.

Observations on color showed a range of from 0 up to 80 parts per million before the use of the impounding reservoir and from 5 to 60 parts since then, with an average increase in color of from 10% to 30%. The authors considered that the increase was largely due to decaying vegetation, as the reservoir site was not stripped before filling; and they thought it probable the amount of color would decrease somewhat with time.

Observations of alkalinity available were too few to indicate any very definite effect of the reservoir on alkalinity. "It is likely that the reservoir will tend to stabilize the alkalinity and prevent it dropping so low as to necessitate the use of lime at the filter plant," which addition had been necessary for a few days during large floods prior to the use of the new reservoir.

The bacterial analyses show wide variations in the number of bacteria in the raw water. "There is not much indication that the impound-

ing reservoir has had much influence on the number of bacteria in the river water except, perhaps, the first few months while the reservoir was filling. However, the number of the observations are too few to give decisive indications."

Tastes and odors in the filtered water gave considerable trouble during January and February, 1923, which were attributed to Synura. They were reduced to some extent by using an excess of alum and chlorine in the filtration of the water. Unfortunately, little record had been kept of micro-organisms in the river water both before and after the construction of the new reservoir.

Data as to the use of sulphate of alumina as a coagulant and chlorine for sterilization indicate an increase in the amount of alum required when the temperature of the raw water is from zero to five degrees Centigrade over the amount required when the temperature is from 25 to 30 degrees, the increase being about 25% for average turbidities of 50 parts per million and 100% when the turbidities reach 200 to 400 parts. There was, however, a decided decrease in the turbidity of the raw water, as already stated, and a corresponding general reduction in the amount of alum used.

There was a material increase in the amount of chlorine used, part of which may probably be accounted for by the increases in the number of bacteria in the raw water. The larger part, however, was probably due to decreased efficiency of the filter beds. These beds had originally consisted of 9 or 10 inches of graded gravel and 30 inches of silicated sand with an effective size of 0.32 and a uniformity coefficient of 1.81. The thickness of the sand beds had been reduced to about 24 inches by losses in washing and cleaning and the size of the sand grains had been enlarged by a coating of iron and manganese. The effective size had increased to 0.56 in February, 1923, and to 0.57 in March, 1924, with a uniformity coefficient of 1.13. At the time the paper was written arrangements were being made to replace the filter sand.

As a concluding summary, the author stated: "The data available to date covering the operation of the filter plant at Decatur before and after formation of the new impounding reservoir indicate that the reservoir is a material benefit in reducing the load on the filter plant."

Sliding Mountain Affects Water Supply

Rhymney Valley, South Wales, is troubled with a sliding mountain, which by its advance dislocates the public services. Two stoppages of the water supply occurred in one week at Troedrhiwfnwch, but nothing more serious than an occasional burst is now expected. Some of the pipes have been pushed out of position in all sorts of ways, and the progress of the mountain must have some further effect on them.—From "Municipal Engineering," London.

We would think the pipes and other internal organs of the natives of the village named would be "pushed out of position" in their efforts to pronounce the name of their home town.

Sensitive Turbidity Detection

Also a standard of clarity of filtered water proposed by John R. Baylis as a result of investigations at Baltimore.

In the issue of Public Works for January 7, 1922, there appeared a description by John R. Baylis, principal sanitary chemist of the Baltimore Water Department, of an apparatus devised by him for "sensitive detection of suspended matter." Since that time Mr. Baylis has been developing the same and related ideas and methods, the result of which he has given in a paper in the July issue of the Journal of the American Waterworks Association entitled, "Sensitive Detection of Suspended Matter and a Proposed Standard of Clarity in Filtered Water."

Mr. Baylis divides the turbidity of filtered water into two general classes, one consisting of fine particles resulting from imperfect coagulation, the other of fairly large size coagulated particles passing the filter beds. The remedy for the former is a change in the amount of coagulant, while the remedy for the latter is that the filter bed should receive attention.

The device described in the article in Public Works referred to was and still is used at Baltimore for sensitively detecting floc in the filtered water, but does not measure the amount.

The author states that practically no effort has been made to develop a method of accurately determining the turbidity of filtered water. "If we cannot tell whether water has a turbidity of 1 or 0.1, how are we going to ascertain the proper amount of chemicals to use and when to wash filters?" Many filter plant operators hold the opinion that the almost universal use of chlorine has obviated the necessity of operating filters at their greatest efficiency, but the author does not concur in this opinion. He believes that the consumers are willing to pay for the clearest possible water, and that waterworks officials will incur much less criticism by increasing expenditures to obtain improved results than by allowing the quality of the water to deteriorate even though thereby they reduce the cost to the taxpayer.

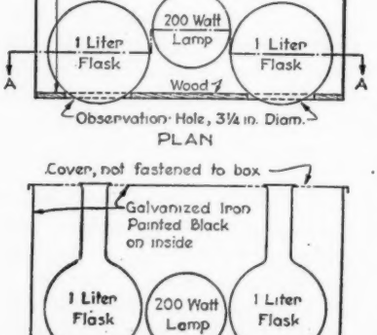
Mr. Baylis has devoted considerable time to devising methods for accurately measuring these two classes of turbidity, which he calls "floc turbidity" and "colloidal turbidity." "Most of the experimental work on chemical treatment of water for clarification loses much of its value because accurate turbidity determinations have not been made on the water after filtration. . . Until there is greater accuracy and more uniform

methods of procedure, progress is going to be slow."

He describes a turbidimeter developed in 1923 which will not only tell turbidities as low as 0.1, but is not affected by colors below 5 and very little by those up to 15. The illustration shows two vertical sections of this turbidimeter. Two glass tubes of the same size and each 75 centimeters long are set side by side in a box, one to hold the sample and the other a solution of known turbidity. Comparison is made by looking down through the water in the tubes. The lamp contained in the box throws a light through the vertical sheet of blue glass which is reflected vertically through the tube. The white light of the lamp also passes through the sides of the glass tubes. The aim is to get a very bright light shining on to the particles in suspension so as to illuminate them and a perfectly blue light shining upward underneath the tubes. With clear water containing no matter in suspension, the bottom shows blue, but when there is suspended matter, the white light reflected from the particles in suspension cuts out some of the blue rays. Most of the blue is cut out with a turbidity of 1, but turbidity differences may be detected as high as 2. A turbidity of 0.1 is easily detected and differences of 0.1 are readily noticeable when the turbidity is below 1.

For his standards, he recommends adding two or three grams of Fuller's earth to about one liter of water, thoroughly agitating and allowing to stand for 24 hours. Part of the supernatent liquid is poured off and tested for turbidity with the Jackson candle turbidimeter; more earth being added if necessary to obtain a turbidity of at least 25. Portions of this solution are then diluted to the desired turbidity. These standards should be renewed every two or three weeks.

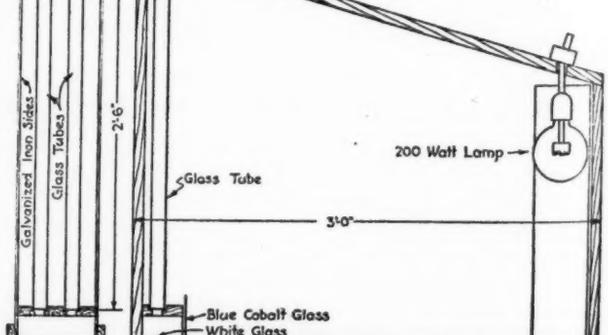
The device gives a measure of the total suspended matter, which may be partly colloidal and partly floc. With turbidities below 1, the floc may be of much greater importance than the colloidal matter. "No rapid sand filter plant filtering coagulated water is entirely free from floc passing the beds all or most of the time. A few operators may wish to challenge this statement, but the use of devices herein described will prove its correctness."



FLOC DETECTOR.

In order to determine the amount of floc, take water with a turbidity of 20, obtained by diluting higher turbidity with clear tap water, and add 1.5 grains per gallon of alum. Stir fifteen minutes and fill a flask about one-half full with this solution and agitate vigorously for one-half minute. This constitutes the stock solution, which may be kept for a month or more but should be thoroughly agitated each time it is used. One c.c. of this solution diluted to one liter of clear distilled water will form a turbidity that is one-thousandth of the original. One c.c. per liter is a floc turbidity of 0.02. Standards are prepared varying by 0.02 below 0.10 turbidity and by 0.05 above it. For comparison, the device shown in the illustration is used, a modification of the floc detectors previously described.

To use the floc detector for this purpose, the sample to be tested is thoroughly agitated for one-half minute, given a whirling motion in the flask and put into the floc detector, where it is compared with standards above described and similarly agitated. At the Montebello filters in Baltimore a sample is taken every two hours and daily tests made of composite samples; three tests being made—one in the laboratory turbidimeter to determine the total turbidity, one in the floc detector to determine the floc turbidity and the third in the laboratory turbidimeter to determine the colloidal turbidity. Floc turbidity is determined as just described. Colloidal turbidity is determined by filtering a portion of the composite sample through filter paper that has been thoroughly washed by filtering at least two liters of clear water, then making the same test as for total turbidity. In making this test, one tube is filled with the composite sample and allowed to stand at least five minutes for the air bubbles to rise to the surface. The other tube is filled with one of the standards, allowed to stand at least five minutes and the comparison made; then, if necessary, another standard is tried until one similar to the sample is found. After a little practice it will be found necessary to use only one or two standards for comparison to make an accurate determination.



TURBIDIMETER FOR SENSITIVE DETECTION OF SUSPENDED MATTER.

Activated Sludge as a Fertilizer*

By V. H. Kadish† and O. J. Noer§

Milwaukee Sewerage Commission plans to produce a fertilizer attractive in form as well as valuable for farms, golf courses and lawns.

When Milwaukee's activated sludge sewage disposal plant goes into operation about a year hence, 100 tons of fertilizer material will be manufactured daily. The word "manufacture" is used advisedly because it will be a manufacturing process in the strictest sense. The suspended and colloidal solids from Milwaukee County's sanitary sewage and industrial wastes will be converted into a dry, brownish-black granular material valuable chiefly as a source of nitrogen in organic form for fertilizer purposes. All of the finished product will have passed an eight-mesh screen in which condition it will be suitable for mixing with other ingredients by fertilizer mixers and manufacturers. Chemically the sludge will be practically uniform in composition at all times; a typical analysis is as follows:

	Per cent.
Moisture	6.2
Total nitrogen as ammonia	7.42
Water soluble nitrogen as ammonia	1.13
Active water insoluble nitrogen as ammonia (alkaline permanganate method)	4.17
Availability of water insoluble nitrogen	66.35
Total availability of nitrogen	71.5
Total phosphoric acid	2.36
Potash (water soluble)	0.13
Fat	4.87
Ash	25.0 -30.0

For the first time in the history of sewage disposal on a large scale, it is planned to produce a fertilizer material in such attractive form that it will find ready sale at a price at least equal to the cost of production. With large scale production looming, it was decided to attempt the development of a broad market by means of scientifically conducted experiments in the field in comparison with those commercial fertilizers commonly used. Consequently, the Sewerage Commission in February, 1923, established a fellowship in the college of agriculture, University of Wisconsin, as a first step in this plan.

Through the work of O. J. Noer, Fellow, under the direction of Prof. E. Truog of the Department of Soils, it was found, in 1923, when using Ottawa quartz sand cultures in greenhouse experiments, that oats and corn utilized 40% of the nitrogen of activated sludge during a period of 60 days. In field trials activated sludge proved to be well adapted to use on golf courses in connection with top dressing materials for putting greens; also as a source of nitrogen in lawn fertilizers; and in mixtures for field crops having a relatively long growing season such as corn and potatoes.

Encouraged by the 1923 results, the scope of the work, both in the greenhouses and in the field, was greatly extended during the present year. The availability of the nitrogen of sludge is being compared to that of common nitrogenous fertilizer materials. In the field, the fertilizer value of the nitrogen of sludge is being compared to that of sulphate of ammonia, dry blood and tankage; sludge mixtures are also being compared with commercial mixtures and with mixtures in which nitrogen is partly derived from sludge and the balance from sulphate of ammonia and nitrate of soda. Golf course and lawn experiments have been elaborated; activated sludge is now being used on some thirty-five representative courses in the Middle West. A preliminary test on carnations has just been completed and a comprehensive series of tests in a commercial greenhouse is now under way in which sludge is being compared with manure and blood in rose culture.

In greenhouse experiments the availability of the nitrogen in sludge is being compared to that in nitrate of soda, dry blood, low and high grade tankage, cotton seed meal, hoof meal, processed leather and garbage tankage. Two series are under way, one cropped to oats, the other to sudan grass. While final data are not available yet, sludge is comparing favorably with the other organic nitrogenous materials.

FERTILIZER EXPERIMENTS ON FIELD CROPS.

Thirty-three series of plots have been established in Wisconsin and Illinois on corn, cabbage, tobacco, cucumbers, cauliflower, onions, tomatoes, potatoes and muskmelons. Sludge has also been supplied for orchard fertilization in Door County, Wisconsin, and in northern Michigan.

Early cauliflower and early cabbage showed a marked response to complete fertilizer, the best growth occurring where one-third of the nitrogen was supplied from sludge, one-third from ammonium sulphate and one-third from nitrate of soda.

Tomatoes are showing a marked response to nitrogen fertilization. Again sludge is showing up very favorably as a source of nitrogen.

On cucumbers the fertilizer was applied at the rate of 250 lbs. per acre below the seed. Best results were obtained with a 4-8-6 mixture in which half the nitrogen was supplied from sludge and the balance from sulphate of ammonia.

Corn is showing marked response to hill drop fertilization at the rate of 150 lbs. per acre. Sludge alone does not produce much increase in growth because phosphates and potash are also required. The sludge mixtures compare favorably with commercial mixtures, especially where one-half the nitrogen is supplied from sludge and one-half from sulphate of ammonia.

The tobacco plots are showing marked results from fertilization at the rate of 1,000 lbs. per acre. The best growths are being obtained from a 4-8-6 mixture in which one-third of the nitro-

*Condensed from paper before the American Society for Municipal Improvements.
†Assistant to Chief Engineer.
§Special Fertilizer Investigator.

gen is being supplied each from sludge, nitrate of soda and sulphate of ammonia.

All potato plots are located on light textured soils, sands to sandy loams. A complete fertilizer is showing the best results. The 4-8-6 mixture containing one-half the nitrogen from sludge and one-half from sulphate of ammonia is fully as effective as the commercial mixtures. Rates of application varied from 500 to 1,000 lbs. per acre.

FERTILIZER EXPERIMENTS ON GOLF COURSES.

In line with the desirability of developing specialized uses for sludge, its application to golf course fertilization was first undertaken in 1923. The results were so gratifying that this work was intensively pushed in 1924 with the result that its value for this purpose has been fully demonstrated and has now passed the experimental stage. Golf courses are increasing by leaps and bounds and should logically furnish a constantly expanding market for sludge.

With the 1923 experience behind us a convenient method of treating greens was worked out. One hundred pounds of sludge were broadcasted over 3,000 square feet of green and a top dressing consisting of soil and sand was spread over the layer of sludge. Results have invariably appeared within about a week to the extent of a heavier growth of grass of a darker green color. The effect of one application lasts from six to eight weeks with the gradual releasing of the nitrogen as plant food. With sludge there is no danger whatsoever from so-called burning; it is cheaper than any material now being used, and the labor cost of applying is at a minimum. Greens have been treated successfully throughout the Middle West on representative courses in Chicago, Milwaukee, St. Paul, St. Louis, Detroit, Cleveland, etc.

Sludge is also being used to replace manure in the construction of new greens and in the planting of new nurseries. Extensive fairway experiments are also under way with promising results but final conclusions on these phases of work must necessarily be deferred until next season.

FERTILIZER EXPERIMENTS ON LAWNS.

As a result of trials during 1923 it seemed advisable to add some phosphate and potash and a very small quantity of nitrate of soda to sludge to make a good lawn fertilizer. As a result a 5-6-4 mixture was compounded which has been used on fifty lawns this year with marked success. Applications of 2,000 lbs. per acre were made without any evidence of burning. The fertilizer produced a darker green color and a heavier growth of grass.

A large lawn experiment is now under way. The new stadium field of Marquette University, Milwaukee, comprising 2½ acres, was sodded on September 19; the 5-6-4 mixture was broadcast over the sod at the rate of 2,000 lbs. per acre, and it is hoped to produce a firm, playable football turf by October 18.

FERTILIZER EXPERIMENTS IN COMMERCIAL GREENHOUSES.

On November 20, 1923, a section of a bench of carnations was treated with 75 lbs. of sludge and 30 lbs. of 24% acid phosphate per 500 square feet. By January 1 the plants in this section had taken on a deeper color and were beginning to grow more freely than those in the blank section. By March 1, the stem growth was much thicker and taller and there were fewer so-called splits. From February 21 to June 1, when the plants were destroyed, the sludge plot yielded 896 blooms against 696 for the untreated plot, or an increase of 30%.

A large scale experiment on roses has recently been started in which the value of sludge as a substitute for manure is being tested. In preparing soil for roses in greenhouse culture it is general practice to mix large quantities of manure with the soil prior to benching. Later, during the growing season it is customary to apply blood and bone as a top dressing to supply nitrogen and phosphorus.

In some sections of the greenhouse sludge has supplanted manure entirely and in others varying mixtures of sludge and manure have been used for benching purposes. Later on sludge and acid phosphate will be compared with blood and bone as a top dressing material. Already the rose plants on those plots to which 150 lbs. of sludge per 500 square feet of bench space were applied, are larger and more vigorous than the plants receiving manure and combinations of sludge and manure. Definite data, however, will not be available for some time.

While much of the work reported is pioneer in nature, by the end of 1924 a huge mass of carefully secured scientific information concerning the fertilizer value of activated sludge will be available which should definitely establish its place and value in the fertilizer world.

Water Works Pumping Plants

In our May issue we published tables and summaries giving information concerning the kinds of pumping plants used by several hundred cities of the country. Since then we have received similar information from thirty other cities, which we summarize below.

In *regular service,* electricity alone is used as power by Harrisburg, Ark.; Pittsburg and Redding, Cal.; East Moline, Ill.; Estherville and Red Oak, Ia.; Newton, Kan.; Covington, La.; Auburn, Neb.; Rockaway, N. J.; Solvay, N. Y.; Chickasha, Okla., and Trenton, Tenn.—13 cities.

Steam alone is used by Leadville, Colo.; Peoria, Ill.; Keokuk, Ia.; Cynthiana, Ky.; Brookhaven, Miss., and Marion, O.—6 cities.

Gas alone is used by Mansfield, La., and Sewickley, Pa.—2 cities.

Both electric and steam are used by Covington, Ga.; Marysville, Mo.; Fremont, Neb., and Morehead City, N. C.—4 cities.

Steam, electric and oil are used in Lincoln, Neb. Steam, electric and hydraulic in Pottsdam, N. Y. Steam, electric and gas in New Bern, N. C. Gas and electric in West Newton, Pa. Steam and oil in Sioux Falls, S. D. In these combinations, steam appears 4 times; electricity, 4 times; oil, twice; gas, twice; hydraulic, once.

In *plants in reserve*, electricity alone is used by Harrisburg, Ark.; Redding, Cal.; East Moline, Ill.; Estherville and Red Oak, Ia.; Covington, La.; Chichasha, Okla., and Trenton, Tenn.—8 cities.

Steam alone is used in Leadville, Colo.; Covington, Ga.; Peoria, Ill.; Keokuk, Ia.; Cynthiana, Ky.; Auburn and Fremont, Neb.; Morehead City, N. C.; Marion, O.; Sewickley, Pa., and Sioux Falls, S. D.—11 cities.

Both electric and steam in Pittsburg, Cal. Oil in Lincoln, Neb. Gasoline in New Bern, N. C. Gas and electric in West Newton, Pa.

Changes have been made during the past five years as follows: From gas to electricity by Pittsburg, Cal.; from steam to electric by Covington, La.; from steam duplex to steam centrifugal by Brookhaven, Miss.; from steam to electric by Auburn, Neb., and by Trenton, Tenn. More electrics were installed by Marysville, Mo., and New Bern, N. C., and an additional oil engine by Sioux Falls, S. D.

Marl-Asphalt Road in North Carolina

Development of a new type of construction to permit using the only locally available material.

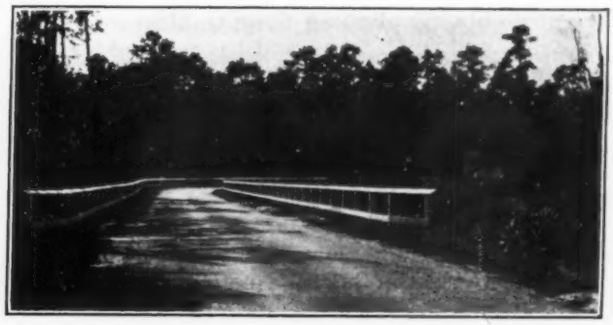
The Third District of North Carolina's Highway System, in the southeastern part of the state, contains little if any native road-building material such as gravel or stone, except some marl rock deposits along the coast. This is an agricultural district and good transportation is necessary, while high cost of road construction must be avoided. Two projects were constructed in this district this year, of what is known locally as the "marl-asphalt" type of pavement, one of the projects being about 13 miles long and the other about 9 miles. This is believed to be different from any kind of pavement that has yet been built.

The marl-asphalt pavement was a development reached through many changes from original specifications, made necessary by the many difficulties encountered in attempting to carry out the original contract. The original contract called for a water-bound macadam made with local marl rock, which should be 8 inches thick after compaction. Test pits were dug at the most likely location for marl rock and strata 8 feet or more thick were found with an average overburden of 4 feet of clay. The marl rock is of a limestone shell formation containing approximately 30% lime and the remainder silica, iron and alumina, possessing excellent cementing qualities and hardness after bonding, but only fair toughness or resistance to wear. Two distinct grades of material were found, one a hard, well stratified rock, and the other a real marl which, in its natural state contains a large amount of moisture making it look like so much gray mud. The contractor, L. W. Lacy of Wilmington, N. C., installed a P. & H. steam shovel for stripping and quarrying the marl and a pumping equipment for keeping water out of the quarry, the surrounding country being only a few feet above Cape Fear river. When only a small amount of rock had been removed and of macadam road constructed, it was discovered that the percentage of hard rock was far below what had been anticipated, running less than 20%, while the softer marl ran over 80%. Instead of having, as was believed, a stratum of hard rock on top of the marl, it lay in pockets and veins.

It was quite evident that it would be impossible to obtain enough hard rock to build the road according to specifications, and following a conference between the State's engineers and the contractor, a supplementary agreement was drawn up providing for a base of marl 5 inches thick after compaction and a top course of hard rock 4 inches thick with a maximum of 25% marl. In return for permission to use the marl, the contractor agreed to add 1-inch thickness to the road and reduce the unit price from $1.26 per square yard to $1.20 on one contract, and from $1.75 to $1.69 on the other.

After completing about three miles under this agreement it became apparent that there would not be sufficient hard rock for this construction. Soft rock spread for the base got far ahead of the hard wearing surface and the base which remained uncovered waiting for the surface course began to wear so rapidly from traffic as to make it almost impossible to maintain it. Another conference was held and another agreement entered into to construct a base 6 inches thick,

PIT FROM WHICH MARL IS OBTAINED.



COMPLETED MARL-ASPHALT ROAD.

using the run of the pit, or marl and hard rock mixed together, and import hard stone for the top course, which was to be 2 inches thick after compaction. This proved unsatisfactory to both parties, as the imported stone was prohibitively expensive, and it was difficult to get a well bonded surface; and a final agreement was reached to construct a base 6 inches thick using pit-run marl, and a wearing surface of 2 inches of standard sheet asphalt, using local sand that met specifications; all to be confined between 2-inch by 8-inch wood headers, either cypress or yellow pine.

In order to allow for the irregular wearing of the marl base, a sand-asphalt cushion consisting of 94% sand and 6% asphalt, was used, varying from ¾-inch to 2 inches, while the wearing surface was reduced to not less than 1½ inches. The cushion is used for levelling up the rutted marl and is thoroughly rolled, and the top is then laid as near as possible up to the maximum specifications of 350 degrees Fahrenheit, so as to make a good bond. All samples cut out show a perfect bond between the cushion and top. The unit prices for the marl-asphalt pavement were $1.75 per square yard on one contract and $2.00 on the other.

In building the road the wood headers are set, supported by stakes 24 inches long, the marl rock is hauled in trucks and spread on the rolled subgrade to a thickness of 8 inches (allowing 2 inches for compression). It must be allowed to dry out for several days before it can be properly rolled with a 10-ton roller. It was found that the marl bonded as well when dry as when in any condition of moisture. When placed on the road, the marl was about the consistency of green concrete, although the more moisture the contractor could get out at the quarry the better, as hauling was drawn on a ton mileage basis. A fleet of from 90 to 100 Ford trucks were used in hauling the marl.

It is too soon to form a final opinion on the subject, but from all appearances the marl-asphalt will compare favorably with standard sheet asphalt on concrete base, in the opinion of the highway engineers.

Planting on Pennsylvania Roads

The Pennsylvania Department of Highways desires to make its new roads attractive, especially the new cuts, by planting them to blossom-bearing vines and small trees, and has notified its engineers that they may make requisition for vines and other growths to be used for this purpose. The department officials have consulted the Departments of Agriculture and Forests and Waters, the State Botanist and others, and is prepared to furnish approximately 300,000 vines which will include wild roses, rambler and creeper roses, the matrimony vine (which in Spring has a yellow blossom), the kutzu vine (which bears a colorful berry), the bush honeysuckle (the blossoms of which range from white to red), the yellow forsythea, shrub dogwood with its white and pink blossoms, spirea which bears white blossoms, the snow berry, Japanese barberry and liberty iris. There will also be used ten grasses for slope planting, including white clover, pink alsike clover, blue hairy vetch purple alfalfa and yellow vaccaria. These grasses will be used in conjunction with orchard grass, meadow fescue, tall meadow oat grass, Canada blue grass and perennial rye grass.

Asphalt in 1923

The Department of the Interior has made public figures compiled by the Geological Survey showing that the asphalt and related bitumens produced in the United States during 1923 exceeded both in quality and value those produced in the previous year. Sales by producers were as follows: Native asphalt and related bitumens, 400,236 short tons, valued at $2,885,631; asphalt made from domestic petroleum, 995,654 short tons, valued at $13,060,174; asphalt made from Mexican petroleum, 1,378,722 short tons, valued at $16,840,045. The exports of unmanufactured asphalts were 72,628 short tons, valued at $1,500,869, and the exports of manufactured products were valued at $1,154,976.

California Highway Notes

The following items of interest to highway engineers and contractors appeared in the August issue of "California Highways," the official publication of the California Highway Commission:

Steam and gas shovels are having a hard-fought battle for supremacy in work accomplished in the reconstruction and straightening of the alignment of the Redwood highway, approximately forty miles north of Willits, in Division I. In three weeks, 31,000 cubic yards were excavated by and hauled from a ¾-yard P. & H. gas shovel and a ¾-yard Erie steam shovel working double shifts. In one week's run, there was a difference of only nine swings between the two shovels.

Motor equipment entirely is handling the grading contract of J. P. Holland on the Skyline Boulevard between Half Moon Bay and the La Honda road. Grading has been completed on the original six-mile contract and the contractor is now at work on the extension. A force of five steam shovels, seven tractors, and fifteen five-ton trucks are in operation.

Fair progress is being made at Sherwin Hill, twenty miles north of Bishop, where surfacing with crushed rock is under way. A well-compacted surface has been secured without any moisture whatever. The results are a striking example of what can be accomplished by persistent dry dragging.

Calcium chloride is being used extensively for the curing of concrete pavement on the George Oswald contract between Shoup avenue and the westerly boundary of Los Angeles County, due to lack of water. Over seven miles of pavement have been completed and cured by this method.

PUBLIC WORKS

Published Monthly
at 243 W. 39th St., New York, N. Y.

S. W. HUME, President J. T. MORRIS, Treasurer

Subscription Rates
United States and Possessions, Mexico and Cuba $3.00 year
All other countries ..... $4.00 year

Change of Address
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Telephone (New York): Pennsylvania 4290
Western Office: Monadnock Block, Chicago

A. PRESCOTT FOLWELL, Editor

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Why Attend Conventions?

During the week of September 29-October 4 conventions were held by two societies of special interest to our readers—the American Society for Municipal Improvements, which all of them should belong to, and the New England Water Works Association, a large percentage of whose members live outside of New England. Neither was as well attended as it should have been.

President Heffernan, of the N. E. W. W. A., in his presidential address, stressed the desirability of attendance at the conventions and taking part in them, and his excellent advice applies to members of all similar societies composed of earnest officials in the public works field. Said he: "We are gainers by our membership through the knowledge we obtain, by what we learn of others' experiences, the difficulties they encounter and how they overcome them. In some places superintendents are doing things in the same way they were done 25 years ago. If the governing body directing the efforts of the superintendent could be made to realize the benefits to be obtained by membership in the association I feel sure they would see that their superintendent had the time to attend the meetings and his expense money, too.

"We must have more papers from superintendents —papers telling of practical experiences. Tell us about the tools, appliances or accessories that have made your work better or easier. Remember that very few of the things we know were the result of our own experience. By far the greater part of our knowledge developed from what some one told us or what we read somewhere. Loosen up! Let others know what you know and come here and learn what others have to tell you."

Municipal vs. Contract Street Cleaning

In the article published in this issue describing street-cleaning methods in Philadelphia, C. A. Howland, engineer of the Bureau of Municipal Research of that city, has greatly condensed a most interesting report recently issued by the Bureau of Municipal Research which gives in detail the conditions that were found to exist in connection with the cleaning of streets and collection and disposal of refuse by municipal forces in Philadelphia. Until January 1st, 1922, all of this work had been performed by contract. In comparing contract and municipal performance of these functions, the report contains the following opinions:

"Contract work involves the difficult problem of enforcing compliance with the specifications of the contract. This is particularly difficult in street-cleaning, requiring as it does a number of more or less irregular operations necessitated by the constantly varying traffic, and climatic and local conditions, for which it is impossible to prepare definite specifications. Moreover, as the results to be obtained are intangible and the degree of cleanliness demanded is difficult to specify, constant inspection of the work of each unit of the organization is necessary. Adequate inspection by the city of the work of the contractor, besides being practically impossible, would be extremely expensive to attempt and would result in a duplication of the overhead charges for which the citizen must pay. On the other hand, the way is open for the contractor to reap exorbitant profits by cutting every corner. It is decidedly to his financial interest to control the city's supervisory forces, hence the contract system introduces a baneful influence into municipal politics. Under the plan of making contracts for one year only, which the city followed, competition among bidders was almost non-existent, and new bidders hesitated to enter the field. A contractor had to make the necessary outlay, with a certainty of only one year's operation, in addition to the uncertainty of the attitude of the city's supervising forces."

Concerning the municipal operation during the past two years, the report states: "The analysis presented in the foregoing pages indicates that

the municipal operations in 1922 were conducted at a cost materially less than the probable cost of the work if done under contract, and at a cost less than that under contract operation in 1920.

"Although the saving in cost is important, of even greater importance are the high degree of satisfaction obtained under municipal operation and the noteworthy start made toward providing suitable plant and equipment, particularly for refuse disposal. The city has also lessened materially the contractor influence in municipal affairs. There can be no doubt, therefore, that the change to municipal operation has been financially beneficial to the city and has proved advantageous in other respects as well."

The examination made by the Bureau was at the invitation of the Director of the Department of Public Works, and it had the fullest co-operation from Director Caven and from his successor, George H. Biles, as well as from the personnel of the Street Cleaning Division. The Bureau has some criticisms to make and suggestions to offer for improvements in the service, but in general its report is very favorable, and it must be a matter of congratulation to the citizens as well as to the officials of the Department that this disinterested civic organization has found the operation of this municipal service so satisfactorily performed.

Public Improvements by Day Labor

Experiences of Lynchburg, Va., and Dayton, O., offer arguments for municipal construction in some cases.

There has been considerable discussion recently, especially by contractors, as to the advisability of doing public work by day labor. Those writing for "The Constructor," the organ of the Associated General Contractors, maintain that work so done almost invariably costs the tax payers more than if done by contract, if all overhead expenses be included. This is largely due to the greater experience of the contractor and his personal interest in keeping costs down, and his freedom to "hire and fire" without pressure from politicians.

Arguments for the other side appear in a paper by Edward A. Beck, city manager of Lynchburg, Va., describing what that city is doing in the way of constructing public improvements with municipal forces. Referring to the argument that day labor is more costly, he says that "This argument is supported by the experience of a number of cities where emergency improvements have been undertaken by their own forces without either an adequate organization or necessary equipment," which, plus financing, are controlling factors in the success of any enterprise. There is no good reason why a city cannot secure organization and equipment equal to that of any contractor, and it must have an advantage in the matter of financing.

Some advantages possessed by the city are its established credit, insuring lower prices and prompt deliveries; ability to secure cash discounts by prompt payment (last year Lynchburg received $2,500 from cash discounts on materials purchased for public improvements); lower freight rates for direct deliveries to municipalities on certain classes of material.

In the matter of operating expenses: "In that it is necessary to maintain general city accounting and purchasing organizations, the municipal construction department need not carry a charge for these essential operations." These departments cost the city money, but in Lynchburg, at least, no more than if it did not handle its own work. Second, municipal activities are so diversified that it is not necessary to carry idle men on the payroll as a skeleton organization. Third, Lynchburg operates a shop for repairing all its equipment and does this work more promptly and at less cost than the average contractor. Fourth, the city saves the cost of contractors' bonds. It also saves a substantial portion of the inspection expense.

In spite of these theoretical advantages, Mr. Beck has found that work of any magnitude can not be effectively and efficiently handled by the ordinary street or sewer department, which is organized with maintenance alone in mind, since a combination of construction and maintenance generally results in more expensive construction than when handled by a crew especially organized for that purpose; also in neglect of maintenance.

Lynchburg therefore established a Department of Public Works essentially to assume jurisdiction over all public improvements, and in it a Bureau of Construction for the sole purpose of building streets and sewers with its own equipment and men. This bureau was organized in March, 1921, after two sets of bids for vertical fibre brick on a 5-in. concrete base brought a low bid $12,000 in excess of the engineer's estimate of $52,200. The bureau did the work for $45,200. In addition, this cost includes some extras for which a contractor would have been compensated, and expense incurred by keeping the street open to traffic more continuously than a contractor would have done. On the other hand, there was a decline in the material and labor market; by which, however, the city would not have profited under a contract.

In sewer work there is an even greater saving in construction by municipal forces, because the uncertainties require the contractor to add a greater margin of safety.

Even disregarding cost, it is believed municipal construction is justified because the city has direct control of the improvement, whereby it is possible to arrange the work with due regard to public convenience, to which a contractor ordinarily gives little, if any, consideration; and be-

cause it can harmonize all types of construction, such as sewers, gas lines, and water installation, which may not be and usually are not a part of a general contract.

For success in municipal construction, Mr. Beck considers two fundamental conditions essential:

1st: There must be adopted a program of sufficient magnitude to insure continuous operation of the construction organization. The reasons for this are obvious. In the city of Lynchburg, sidewalk improvements are largely dependent upon the wishes of individual property owners who contribute a substantial portion of the cost by agreement. Accordingly, the city has no control over the amount, nor can it time the periods for such construction. Hence, the expense of maintaining an organization for that purpose, when it can be engaged only at infrequent intervals, does not result in economy. Therefore, sidewalk construction is not included in the activities of the Municipal Construction Bureau.

2nd: Ample authority must be provided to insure prompt action in all matters affecting the prosecution of the work, particularly in questions of rates of wages, and the purchase of supplies and materials.

During the two seasons that the practice of constructing public improvements by municipal forces has been in operation in Lynchburg, there has been expended over $400,000 in capital betterments and the results have been so satisfactory in every respect that a return to the old contract system would meet with a decided and strong opposition.

The experience of Dayton, O., in building public works by force account is told in a recent issue of the "Dayton Municipal Review" ("Issued by and for the thousand or more employees of the city of Dayton") by Ivan E. Houk, formerly city engineer of Dayton. This experience, he says, "has shown that such methods are often, not always, advisable. In general, such methods have been found economical in times of unemployment, when first class foremen and efficient labor are plentiful at reasonable prices; in cases of comparatively small jobs of ordinary nature where the costs of organization and preliminary preparations are relatively large proportions of the total cost; at times when the city has idle equipment suited to the work in question; and in instances where the contractors have combined with the intention of controlling construction costs."

Among the advantages, he finds the possibility of starting the work before the plans are completed or making changes in them as the work progresses. On the other hand, contractors are not so strictly bound by the 8-hour law (in 1923 Dayton had trouble in getting common labor because the best men preferred to work 10 hours a day for contractors); they are not so hampered by government red tape; they also may have suitable equipment or organization idle when the city has not. Under the last condition Dayton has awarded grading jobs at prices that could not possibly have been lower by force account construction.

During recent years Dayton's director of public service has done work by force account "whenever and wherever the character of the work or the existing labor and contract conditions showed such procedure to be justified. Of the million and a half dollars worth of work executed in 1922 and 1923, approximately 25 per cent was carried on by force account, including practically all of the new sewer installations (owing to an apparent combination of contractors to maintain high prices) and much of the sheet asphalt resurfacing and some new asphalt and brick paving on old base. A good part of the work was begun in the fall of 1921 when the unemployment situation was worst, primarily to provide work for the needy. However, it developed considerable money could be saved. Construction companies, because of lack of work, were glad to loan the city their best foremen and to rent their equipment at reasonable prices, and first class common labor was abundant at 35 cents an hour. A reinforced concrete culvert estimated to cost $19,000 was built for $12,350. In 1919 a sewage pumping station was built at a total cost of $13,688, for which the bids received ranged from $32,000 to $36,000.

The saving on the sewer work was not so great because, the aim being to furnish labor for as many men as possible, new men were put on each week and old ones laid off, and little machinery was used, the concrete being even mixed by hand. In more recent sewer work Keystone diggers, trenching machines, concrete mixers and other types of machinery were used, and the costs were less and savings greater.

"In the case of the sewer work competition among foremen, as well as full information regarding the progress on the various jobs, and consequently, knowledge regarding the abilities and efficiencies of the foremen, was obtained by a system of weekly reports. These were prepared by the engineer in charge of the sewer work, and showed the total amount of work completed to date, the estimated cost of same, the actual cost, and the accumulated balance or deficit. When the time came to reduce forces these reports furnished a conclusive basis for action.

"Minor sewer installations, such as are being continually required in cities of appreciable size, constitute a class of work which probably should be done by force account in all instances. These jobs are really of a maintenance nature, and should be handled by sewer gangs, organized and operated in much the same manner as the maintenance crews. Similar gangs may be kept busy on the larger sewer jobs, as has been done in Dayton during the last few years; but there may be many instances where it is more advisable to do such work by contract. Minor street paving jobs might also be economically handled by force account methods, especially those of sheet asphalt construction. Most cities of ap-

preciable size own asphalt plants for use in repair work, whereas paving contractors, unless they are specializing in asphalt work, seldom own such equipment. The plants and crews used on the municipal repair work may also be used on new construction.

"Dayton began resurfacing her worn-out brick pavements with sheet asphalt about 4 years ago, doing the work by force account and using the asphalt repair gangs during spare times. Streets carrying car tracks were resurfaced on the shoulders with courses varying from nothing to about an inch in thickness, averaging about a half an inch, at a cost of about 49 cents a square yard, exclusive of overhead. Other streets were resurfaced with courses varying from nothing to 3 inches in depth, averaging about 2 inches, at a cost of about 85 cents a square yard, exclusive of overhead. No work of this nature was done by contract; consequently, no direct comparison of costs by the two methods is possible. However, a few 3-inch courses, on new pavements, the bases of which had been laid by contract, were laid at a cost slightly less than $1.40 a square yard, exclusive of overhead, at a time when asphalt paving companies were getting $1.90 for similar work. Of course, the latter figure had to cover overhead as well as other charges. These jobs were not advertised for bids because they were too small to warrant the bringing of a plant to Dayton. Dayton's asphalt work has been handicapped in the past by the limitations of the plant, a rather ancient type with a capacity of only about 500 yards a day. A new plant, with a capacity of 1,250 yards a day, was purchased last year, so that the work can be prosecuted on a more satisfactory basis in the future.

"Thus far, Dayton has not found it necessary or advisable to do much new street improvement work by force account; except, of course, the comparatively small jobs, which, like the sewer installations, are really of a maintenance nature, and can be handled by the maintenance crews. Satisfactory competitive bidding, resulting in fair contract prices, have usually been obtained in the case of new street work. Force account methods have been used in a few instances where the legislation, started during the period of rising prices, did not provide sufficient funds. In such cases it was considered better policy to do the work by force account rather than by contract. Force account methods were also used in a few instances after the war, on jobs for which no bids could be obtained.

"Force account work in Dayton has not, thus far, been hampered by civil service regulations. While the Civil Service Commission has the authority, under the Charter, to supervise the employment of all classes of day labor, the members of the Commission, in their willingness to co-operate with the other divisions of the city government to the end that the construction work be prosecuted most economically, have not rigidly exercised this authority. They have felt, as have also the engineers, that as far as common labor is concerned, the hiring, and especially the firing, had better be handled entirely by the foremen on the jobs.

"There are undoubtedly times when reliable contractors are exceedingly anxious for work; times when they will bid rock bottom prices in order to obtain it. As long as private jobs are done by contract, we will have contractors; and as long as we have contractors, there will be times when they are unusually anxious for work. Such times were good times to advertise work.

"Each job of appreciable magnitude should be studied individually, and all the various affecting conditions given proper consideration before deciding which method to use. Probably more public work should be constructed by force account in the future than has been so built in the past. However the increase in such activities should be made when and where careful business judgment shows such procedure to be justified, not merely based on a general recommendation that such methods be used in public works construction. As far as municipalities are concerned at the present time, it is only the comparatively small jobs of ordinary nature, such as the small sewer and paving jobs, which are really maintenance matters and which can be handled by the maintenance crews in connection with their routine work, that force account methods can be considered invariably advisable."

Highway Illumination

The Joint Conference on Street and Highway Safety, under the leadership of Secretary Hoover, is endeavoring to work out plans to lessen traffic accidents and has included among these that of highway illumination.

It found that the Pacific States were making rapid progress in illuminating highways. California is planning a highway lighting system for the route between Los Angeles and San Francisco with the aim of diverting much of the commercial truck traffic from day to night. Legislation is to be introduced in Washington and Oregon providing for illumination of highways to increase safety. Michigan leads the other states in respect to highway illumination.

The United States Bureau of Public Roads is recommending further development of the subject. The Conference felt, however, that it would take some time to develop highway lighting even on those rural roads which carry as great a volume of traffic as many city streets.

Calcium Chloride Tests

According to "California Highways," extensive tests are to be made to determine the value of calcium chloride for curing concrete pavements, which tests will be conducted at Sacramento under the direction of the Construction Department of the State in cooperation with the Portland Cement Association. This work has been assigned to C. L. McKesson of the Laboratory Research staff, who is

working in cooperation with Prof. Duff Abrams of the Lewis Institute of Chicago.

The tests will be made with a series of about 300 beams 7 inches by 10 inches by 38 inches, to be cast and cured in the following way: One series covered with earth and water 14 days, another 7 days, and a third 3 days; one series without any covering of water, and another series with 2 pounds of calcium chloride per square yard, another with 3 pounds per square yard, another with 5 pounds; another will have a covering of sodium silicate and still another with waterproof curing paper. The beams will be broken in the laboratory at 14 days, 28 days and 90 days.

It is probable that additional field tests will be made to verify the results obtained by the beam tests, careful records being kept of humidity, temperature and wind velocities.

Field tests were made a few weeks ago on a paving job in Los Angeles County, and it was proposed to make others on a paving job south of Sacramento.

Refuse Collection and Disposal

Statistics collected during the past month from two hundred cities summarized. Municipal collection. Capacities of vehicles. Recent changes in collection vehicles and methods. Methods in use for disposing of garbage and cities employing each method.

Refuse Collection Statistics

During the past few weeks we have collected statistics concerning refuse collection from 200 cities. These cities are scattered over the entire country and are of all sizes, about 23 per cent being approximately 5,000 population, 35 per cent from 5,000 to 10,000, 21 per cent from 10,000 to 25,000, 12 per cent from 25,000 to 100,000, 7 per cent from 100,000 to 500,000, and 2 per cent over 500,000. The statistics would seem, therefore, to be fairly representative of present American practice.

Replying to the question, "Is garbage collected separate from ashes and rubbish?" 139 cities answered "yes" and 51 answered "no." A few do not collect garbage at all and others failed to answer this question for some reason or other.

MUNICIPAL COLLECTION.

Collection of garbage is made by city employees in 94 of the cities and partly by city employees in 3 others, by contractors in 62, by private collectors in 31, by hog ranch companies in 2. The city collects ashes in 86 cases and does not collect them in 107. It collects rubbish in 118 cities, does not collect it in 61 cities, while 8 cities report collections only once a year on special clean-up days.

In making the collections, 136 cities use a total of 2,363 horse-drawn vehicles, while 101 cities use 343 motor-driven vehicles.

CAPACITIES OF VEHICLES.

The capacities of the vehicles is expressed by some cities in cubic yards and in others by tons. Of the horse-drawn vehicles described in cubic yards, the 1½-yard, 2-yard and 3-yard wagons are most popular, each being reported by about 18 per cent of the cities. The other sizes used, in the order of priority, are 2½-yard, 8-yard, 4-yard, 1-yard, 3½-yard and 5-yard. Each of the following is reported by one city: 4½-yard, 5½-yard, 6-yard, 9-yard, 14-yard and 24-yard. The largest sizes are special bodies used for rubbish only. Of the horse-drawn vehicles described in tons, the 1-ton is used by 34 per cent of the cities, the 1½-ton and 2-ton each by about 9 per cent; while the ½-ton, 3-ton, 1¾-ton and 6-ton find use in the order named.

Of the motor-driven vehicles with capacity expressed in cubic yards, the numbers used decrease quite uniformly from 2-yard and 5-yard as the most used, through 3-yard, 2½-yard, 1½-yard, 4-yard, 7-yard, 8-yard, 1-yard, 4½-yard, 6-yard and 10-yard, to the capacities, 3½-yard, 5½-yard, 13-yard and 24-yard, each of which is used by one city. Of the motor-driven vehicles described in tons, 35½ per cent are 1-ton, and the other sizes used, in the order of priority, are 2-ton, 1½-ton, 3-ton, 2½-ton, 5-ton, ½-ton, 4-ton, and 3½-ton.

Tractors and trailers were reported in use by 25 cities. Most of these had only one tractor and one or more trailers, while some of the larger cities had a number of each; the total number of tractors reported by the 25 cities being 52.

SOME SPECIAL METHODS.

Several of the cities gave interesting items of information other than those subject to tabulation. LaPorte, Ind., reports that one-horse wagons collect the garbage, removing the can and placing a clean can or pail in place of it. The garbage is then hauled to the city yard and there the cans are loaded on to 3½-ton trucks by which they are delivered to a hog feeder. He empties the cans and washes them ready for delivery again. The city receives from him 25 cents a ton for the garbage delivered and pays him 2 cents apiece for the first 6,000 cans washed, 1½ cents for the next 3,000 cans and 1 cent for the balance. Last year the city paid $2,304 for washing cans, $7,150 for drivers and helpers, $750 for gasoline, oil and repairs and $220 for feed and shoeing; a total of $10,424. 140,690 cans of garbage were collected from about 2,100 customers, the weight of the garbage being 1,366 tons, for which the city consequently received $341.

Minneapolis uses 30 motor-driven collecting wagons, 3 tractors and 7 trailers. The trucks bring the garbage to three sub-stations, where the removable tank body of the truck is placed on a trailer, six tanks to a load, and the tractors haul these to the incinerator. Garbage is collected from 92,000 families on 50 square miles, with an average length of haul per tank of 7½ miles. The garbage is disposed of by incineration at a cost per family of $2.52 per year for the entire garbage service, of which 80 per cent is for collection and 20 per cent for disposal. The cost of disposal in addition to that of collection last year was $57,120. The city derives a slight revenue from the sale of garbage to farmers at the disposal plant, 9,600 tons having been so sold last year at 25 cents a ton.

In Buffalo, N. Y., 6 tractors and 50 trailers are used in collecting garbage, the trailers being drawn by horses during collection. Garbage is collected from 42 square miles, or 653 lineal miles of street. All three classes of refuse are collected at one time but in different vehicles. The average length of haul of trailer after being filled is 4 miles. The cost of collecting ashes, garbage and refuse last year was $1,005,917. The garbage is fed to hogs.

In Marion, Ohio, the garbage cans are removed and clean ones left in their place by two of the private collectors, while the other two private collectors remove it in barrels.

CHANGES DURING THE PAST TWO YEARS

Of special interest as showing the present trend are the changes made during the past two years in the methods and appliances used in collecting refuse.

A change from horse-drawn to motor vehicles was made by 14 cities—Huntington Park, San Bernardino and Ventura, Cal., Denver, Colo., Chicago, Ill., Brockton, Mass., Adrian and Alma, Mich., Carlstadt, N. J., Tarrytown and Wellsville, N. Y., Johnson City and Kingsport, Tenn., and Appleton, Wis. In a few of the cities named the change was not complete, but a few horse-drawn vehicles still remain in service. On the other hand, Houghton, Mich., and Helena, Mont., report changing from motor to horse-drawn vehicles.

Tractors and trailers were adopted in 4 cities—Cicero, Ill., Minneapolis and St. Paul, Minn., and Buffalo, N. Y.; while Endicott, N. Y., changed from tractor and trailer to truck. More automobile trucks were added by 8 cities—New London, Conn., Dover, Del., Washington, D. C., Ocala, Fla., Somerset, Ky., Morristown, Tenn., Norfolk, Va., and Kenosha, Wis. Muncie, Ind., added special garbage wagons, while Richmond and Roanoke, Va., substituted special dump wagons for the ordinary type.

Change from contract collection to municipal collection was made by Calexico, Cal., and Ludington, Mich.; while Bangor, Me., and Hudson, Mass., changed from municipal collection to contract. Municipal collection was begun at Noblesville, Ind.

Separation of garbage from refuse was begun at Rapid City, S. D. New Iberia, La., began making more frequent collection; Tallahassee, Fla., began collection from the entire city instead of the business area only, as before; while Fernandina, Fla., systematized collection by districting the city.

Tabulated information concerning details of collection methods, amount collected, cost, etc., will be published in our next issue, space not being available in this issue.

Disposal of Garbage

Dumping in its various forms is yet the most common method of disposing of garbage. Some cities reported dumping in old quarries, gullies, etc.; others fill in low land along rivers or lake fronts. Most dump ashes mixed with the garbage, and many rubbish also. Quite a number specify that the dumped material is leveled off and covered with soil, sand, ashes, etc. Forty per cent of the cities reporting dump their garbage; but of these 9 per cent burn the garbage at the dump, some sprinkling it first with inflammable oil.

Somewhat similar to dumping, but avoiding several of the objectionable features of that method, is burying. Seven per cent of the cities report this method, a few of them stating that this is done by farmers with a view to improving the soil.

Feeding to pigs is the practice in almost as many cities—39 per cent of those reporting. A few particularize that only the garbage from hotels, restaurants, etc., is used for feed; others that "a part," "a half," etc., is so used. In the case of at least two cities the pig farm is run by the municipalities, but in the majority garbage is removed by farmers for this purpose. Five cities sell the garbage for hog feed—and possibly others which did not so specify.

Incineration is reported by 12 per cent of the cities. Possibly this should be increased by some of those who reported merely that the garbage is hauled to the dump and burned.

Reduction is reported by 2 per cent of the cities, the smallest of them being Cincinnati.

The cities reporting use of each of these methods, arranged in alphabetical order by states, are as follows:

Dumping:—Talladega and Troy, Ala.; Dover, Del.; Fernandina, Fla.; Fitzgerald, Ga.; Lewiston, Ida.; Charleston, Cicero, La Grange (some), Peru, St. Charles, and Summit, Ill.; Hartford City, Princeton, Tell City and Winchester, Ind.; Catlettsburg, Ludlow, Mayfield, Paris and Somerset, Ky.. New Iberia, La.; Annapolis, Md.; Southbridge, Mass. (about half); New Ulm, Minn.; Vicksburg, Miss.; Havre and Helena, Mont.; Beatrice and Chadron, Neb.; Carlstadt, Phillipsburg, and Somerville, N. J.; Santa Fe and Tucumcari, N. M.; Albany, Endicott, Glen Cove, Gloversville, Johnson City, Johnstown and Tarrytown, N. Y.; Henderson, N. C.; Delaware, Portsmouth, Ravenna and Sidney, O.; Blairsville, Ford City and Pen Argyl, Pa.; Laurens and Sumter, S. C.; Dyersburg and Johnson City, Tenn.; Belton, Tex.; Harrisonburg and Pulaski, Va.; Kenosha, Manitowoc, Oshkosh and Wisconsin Rapids, Wis.

Burned at Dump:—Miami and Nogalis, Ariz.; Napa and Pittsburg, Cal.; Key West and Tallahassee, Fla.; Cartersville, Ga.; Provincetown, Mass.; Houghton, Mich.; Massillon, O.; Shawnee, Okla.; Luzerne, Pa.; Chester, S. C.; Rapid City, S.D.; Morristown, Tenn.; Clifton Forge and Newport News, Va.

Buried:—Hartford, Conn.; (one-half of it); Noblesville, Ind.; Carroll (part) and Cedar Rapids, Ia.; Ludington and Marquette, Mich.; Freehold, N. J. (part); Lockport and Ossining, N. Y. (to improve soil); Bellevue, O. (to improve soil); Marion, O.; Grove City, Pa.; Walla Walla, Wash.; Wauwatosa, Wis.

Fed to Pigs:—Anaheim (sold) Calexico (from restaurants, etc., only); Huntington Park, San Bernardino,

Santa Barbara, So. Pasadena, Ventura and Visalia, Cal.; Denver and La Junta, Colo.; Hartford (half of it) and New London, Conn.; Hinsdale, Kankakee, La Grange (some) and Sterling, Ill.; Bedford, Decatur, La Porte (sold), Muncie, Shelbyville and Wabash, Ind.; Carroll, Ia. (part); Abilene, El Dorado, Horton, Osawatomie and Salina, Kans.; Brockton (municipal), Cambridge (sold), Framingham, Hudson, Mansfield (municipal), Reading Southbridge (half of it), Waltham and Whitinsville, Mass.; Adrian, Albion ("sorted and used for feed"), Alma, Ann Arbor, Hastings, Highland Park, Mt. Pleasant and Sturgis, Mich.; Austin and St. Paul (sold), Minn.; Joplin and Kansas City, Mo.; Freehold, N. J. (part); Buffalo and Watertown, N. Y.; Greenville and Warren, O.; El Reno and Enid, Okla.; Oregon City, Ore.; Dormont, Stroudsburg, Erie, Lansdowne and Norristown, Pa., Providence, R. I.; Denison, Tex.; Brigham and Ogden, Utah; Burlington, Vt.; Walla Walla, Wash. (from hotels and restaurants only).

Removed by Farmers (presumably for pig feed):—Alton and Blue Island, Ill.; Logansport, Ind.; Bangor, Me.; Arlington, Mass.; Summit, N. J.; New Brighton, Pa.

Incinerated:—Marysville and Palo Alto, Cal.; Ocala, Fla.; Americus and La Grange, Ga.; Oak Park, Pontiac and Quincy, Ill.; Ottumwa, Ia.; Hancock, Mich.; Chisholm, Minneapolis and Thief River Falls, Minn.; Depew, Lackawanna and Wellsville, N. Y.; Philadelphia, Pa. (part); Kingsport and Memphis, Tenn.; Dallas and Mt. Pleasant Tex.; Norfolk, Richmond and Roanoke, Va.

Reduction Plant:—Washington, D. C.; Chicago, Ill.; Cincinnati, O.; Philadelphia, Pa. (part).

The question was asked: "What does the disposal cost the city other than cost of collection?" In reply to this, 102 cities stated that they were at no expense for disposal. In many of these the garbage is collected and removed by farmers or other private parties. In others the material is dumped, the only cost being that of collection. A number of the cities employ men at the dumps to level them off, burn inflammable material, etc.

Below are given the costs to the various cities reporting the same, the cities being arranged in alphabetical order. The costs are the cost per year, generally the cost in 1923, except where otherwise stated:

Marysville, Calif., $2,220 for "burning"; Palo Alto, Calif., $5,080 plus $1,300 for accounting; Santa Barbara, Calif., $7,500; Washington, D. C., $167,954, operating reduction plant; Key West, Fla., $250, burning on dump; La Grange, Ga., $600, operating incinerator; Lewiston, Idaho, the cost of one man on dump; Chicago, Ill., $711,283, operating reduction plant; Oak Park, Ill., $10,202, for coal, labor and supplies operating incinerator; Pontiac, Ill., 400 pounds of coal and one man at $4 per day operating incinerator; Decatur, Ind., $720, by contract for collecting and disposal; Hartford City, Ind., cost of man at dump; Logansport, Ind., $5,000, contract for hauling and disposing; Cedar Rapids, Ia., $8,424, burying in trenches; Ottumwa, Ia., $3,135, operating incinerator; Salina, Kans., cost for man at dump; Annapolis, Md., $8,000, by contract for collecting and disposal; Hancock, Mich., $900 a year, for burning; Highland Park, Mich., $1 per ton, to pig farmer; Austin, Minn., $300, rental of dump grounds; Chisholm, Minn., $5,400, operating incinerator; Minneapolis, Minn., $57,120, operating incinerator; New Ulm, Minn., cost of man at dump; Thief River Falls, Minn., $960, for man at incinerator; Beatrice, Nebr., $840, for burying at dump; Somerville, N. J., $1,300 for man a dump; Depew, N. Y., $1,800, operating incinerator three days a week; Endicott, N. Y., $430, covering dump with ashes; Glen Cove, N. Y., $9 per day, for men at two dumps; Lackawanna, N. Y., $2,500, for two laborers and coal at incinerator; Wellsville, N. Y., $800, for burning; Marion, Ohio, $2,900 for burying; Portsmouth, Ohio, $400, for covering with dirt; Sidney, Ohio, $300, rental of dump ground; Dormont, Pa., $8 a ton by contract for collecting and disposing; Norristown, Pa., $10,800, by contract for collecting and disposal; Philadelphia, Pa., $1.75 a ton, for reduction; Luzerne, Pa., $35, for right-of-way; Rapid City, S. D., $1,100, for burning in the open; Johnson City, Tenn., $2.50 a day, for man on dump; Kingsport, Tenn., $7.50, labor at incinerator; Memphis, Tenn., 84.7c. per ton for incineration; Dallas, Tex., 45c. per ton, operating incinerator; Harrisonburg, Va., $720, care of dump; Norfolk, Va., $13,836, for incineration, and $6,417 for dumps; Richmond, Va., $12,869, operating incinerator; Manitowoc, Wis., cost of three men at dumps; Wauwatosa, Wis., $150, for rental of dump.

Quite a number of the cities obtained revenue in one way or another from the garbage. The following amounts were received by various cities for garbage sold to pig farms: Anaheim, Calif., $900; San Bernardino, Calif., $100; Santa Barbara, Calif., $7,500; South Pasadena, Calif., 50c a ton; Visalia, Calif., $1,200; La Junta, Colo., $50; LaPorte, Ind., 25c. a ton; Muncie, Ind., $600; Arlington, Mass., $3,200; Cambridge, Mass., $12,500 at 75c. a cubic foot; Waltham, Mass., $3,000; Minneapolis, Minn., $2,400 at 25c. a ton; St. Paul, Minn., $15,993.

New London, Conn., realized $1,800 in excess of the operating expenses on its municipal pig farm, and St. Charles, Ill., $480.

Washington, D. C., obtained $196,631 from its reduction plant, which was $28,677 more than the cost of treatment. Philadelphia, Pa., made a profit of $80,000 on its reduction plant, or 55c. a ton.

Carlstadt, N. J., by use of mixed refuse, graded streets across swampy land. Kenosha, Wis., using mixed refuse, reclaimed land valued at about $22,000.

Enid, Okla., received 20 per cent of all money collected by the party holding the contract. Oregon City, Ore., received $25 for licensing the party contracting with it for collection.

Street Cleaning Statistics

Recent changes in appliances used by the various cities reporting. Snow removal methods and costs.

Special interest in the matter of street cleaning attaches to the extent to which cities, both large and small, are substituting machinery for hand labor, and motor-driven for horse-drawn equipment.

Probably hand cleaning will always be used to a considerable extent. Only 16 per cent. of the cities reported that they did not use hand brooms at all.

Of the other methods employed, flushing by machine led with 39 per cent, while 18 per cent flushed by hose. Machine brooms were used by 24 per cent. and pick-up sweepers by 19 per cent.

Perhaps even more indicative of present developments are the changes made and contemplated. During the past twelve months, of these cities 32% reported the addition of flushing by machine to their street-cleaning methods, 35% the new use of pickup sweepers, and 32% the introduction of machine brooms.

Changes *contemplated* by those cities were as follows: Use of flushing machines, 54%; use of machine brooms, 31%, and use of pickup sweepers, 15%. It is understood that in each of these

cases the use of one or the other of these three appliances was or is to be a new one for the city in question.

The change from horse-drawn to motor-driven apparatus is even more pronounced than the change in appliances. During the past twelve months, of the apparatus newly introduced into these cities, 88% were motor-driven and only 12% were horse-drawn; while of the changes contemplated for the immediate future, 73% involved motor-driven apparatus and 27% horse-drawn.

Most cities naturally are inclined to continue using the appliances that they have, changing to new equipment only as the old wears out. It is, therefore, all the more significant of the development in street-cleaning methods that each year 15% to 20% of the cities are introducing new types of mechanical equipment.

SNOW REMOVAL

Most of the smaller cities of the country do little in the way of removing snow from the streets, and the same is of course true of all of the cities in the southern states and in California. However, of the 200 cities reporting, 113 practiced snow removal, 7 of these from sidewalks only, however.

The appliances used by the various cities were reported as follows: Snow plows, 66 cities; with 11 additional cities using sidewalk plows. Wagons were used by 36 cities, trucks by 60 cities, sleighs by 5 and carts by 2. The majority of the snow plows were attached to tractors or trucks, 21% reporting them attached to tractors, 41% attached to trucks, while 38% were horse-drawn. Fourteen cities used scrapers or graders (presumably the same used during the summer for street work) instead of regular snow plows. Two used snow rollers, one a revolving broom and three washed the snow off by means of flushers.

Washing the snow off was employed in Brigham and Ogden, Utah, the former washing it down the steep gutters to the river by the use of a flusher, the latter shoving it into the gutter by plows and then washing it into the sewer inlets.

Snow loaders were reported by several cities. Chicago is believed to have been the first to use them and now has four. Albany, N. Y., used a snow loader for cleaning 2 miles of streets after its one storm of last winter, the snow being removed by nine 5-ton dump trucks. Providence last year used a Barber-Greene snow loader and a Keystone digger.

An effort has been made to learn the cost of snow removal. About a third of those removing snow failed to answer the question "What was the cost of snow removal last winter?", or stated that no figures were available. The figures given were divided by the population to learn the cost per capita in each city, and by the product of miles of street cleaned and the number of times cleaned to learn the cost per mile of cleaning. The latter can not be claimed to be of much value because of the differences in amounts of snow removed, and because some only plowed it to one side while others hauled it away. However, as far as possible separate averages were taken of plowing only and of removal; and it was assumed that in no case would light snows be handled. In estimating the per capita costs the cities were divided into those in New England and the Canadian border, the middle belt, and the southern cities. The results obtained are as follows:

Cost per Mile of Cleaning: Figures for plowing only vary from $1.25 to $10.00, the average being $5.26. If we omit the half of the cities showing lowest costs, the average of the others is $8.56.

Figures for cities that hauled away snow from the business districts varied from $20 (in Virginia) to $1,667 (in Wisconsin). The average of all is $307; while omitting the smallest half (all under $150), the average is $560. The object of omitting the half showing least cost is to allow roughly for those cities that have little snow and those that only partly remove it.

Cost per Capita: For cities with northern climates the average cost per capita was 29 cents; or 52 cents if we omit the smaller half (all under 15 cents).

For the middle belt the average cost was 4.6 cents; or 8.3 cents if we omit the smaller half (all under 4 cents).

Six southern cities reported costs varying from 0.9 cents to 6 cents, averaging 2¼ cents.

An extreme illustration of the unexplained variations in cost is furnished by two Iowa municipalities, one with about 5,000 population and the other with about 50,000. Both report spending practically the same amount—$650 and $655 respectively. The smaller cleaned a length of street 1,500 feet long seven times, the larger a length of 2,600 feet twice only. Each used wagons and trucks only, reporting no use of plows. This gives a per capita cost for the smaller ten times that for the larger, but a cost per mile of cleaning only about one-half as great.

Illinois Road Construction Record

Illinois passed the 1,000-mile mark in road building when 53.88 miles of pavement were completed in the week ending October 2d. The officials expect next year to exceed this year's record should the proposed bond issue carry in November. Bids have been called on 286 miles of pavement, to close November 12th, conditional upon the passage of the bond issue.

Garbage Disposal in San Francisco

In San Francisco garbage is collected by individual scavengers, licensed and regulated by the Health Department, maximum rates of charge being established. The scavengers as a body operate the old municipal incinerator without paying the city for its use. This has proved unsatisfactory, and the health officer, on September 24th, recommended contracting with a single party for collection. The Bureau of Governmental Research believes that the "garbage question" will not be settled satisfactorily until taken over as a municipal operation.

New York's Latest Street Cleaner

The street cleaning commissioner of New York City, Alfred A. Taylor, makes a practice of trying out all new street cleaning appliances brought to his attention, if they show any promise of usefulness, with a view to adoption if the test is favorable. One of the latest contrivances to be so tested and adopted was a motor-driven pickup sweeper with a vacuum attachment known as the Butler vacuum street sweeper. Three are now in use, one in Manhattan, and two in Brooklyn. Through the courtesy of the commissioner we are able to present the following facts and figures concerning the tests and description of the machine.

The machine has the general appearance of a rather large delivery wagon with two excrescences in the rear, slots in the sides, and wheels on the side next to the street, as shown in the illustration. It is 18 ft. 6 in. long over all, 6 ft. wide and 7 ft. 6 in. high. It weighs 4½ tons. The chassis is of special design but using chiefly standard parts. The body is of angle iron and sheet metal.

A broom 5 ft. long and 44 in. diameter is supported flexibly in the rear and makes 250 r.p.m. Above the broom is a 20 in. suction fan that rotates about 1500 r.p.m., the suction end connected to an air-tight sheet metal compartment which entirely encloses the broom and ends at the bottom in a strip of heavy canvas about 4 in. wide which is in contact with the pavement. The fan delivers into an air chamber consisting of 240 3 x 24 in. cloth tubes located in the top of the body, while louvers at the sides allow the cleaned air to escape.

The broom delivers the dirt onto an endless belt conveyor set at an angle of about 60 degrees which conveys it to the dirt hopper in front, where it is received by ten cans with a total capacity of 1¼ cu. yds. While the broom is throwing the dirt onto the conveyor the fan sucks the dust into the air chamber, where it is caught by the cloth filters, the accumulations in which drop into the dirt hopper. No water is used on the street to lay the dust. After rains the fan is not used as its chief purpose is to prevent flying dust.

Power is furnished by a 30-horsepower Waukesha motor, the cleaning system being operated separately from the traction, transmission to fan and broom being by rope, which allows for slipping in case the broom is jammed or otherwise stopped.

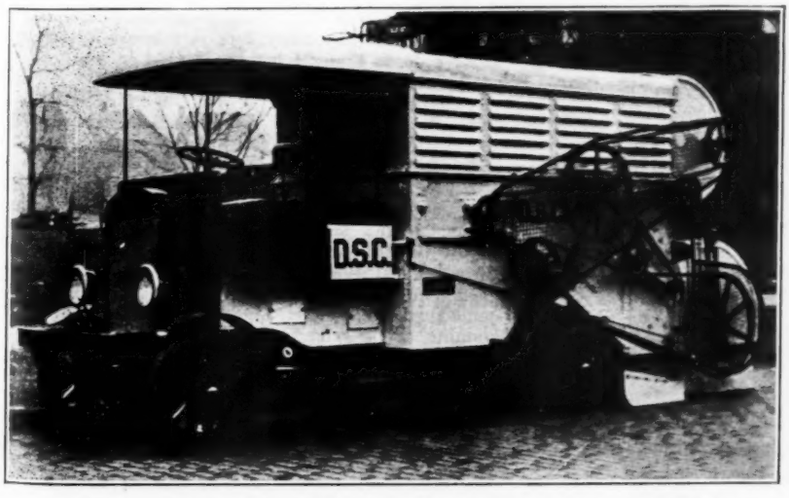
The Department tried out this machine on Fulton Street, West Broadway and Hudson Street on April 8th of this year, and the following day on East Houston and Mercer Streets on April 14th on Lenox Avenue between 110th and 145th Streets, on April 15th on Fifth Avenue between 110th and 120th Streets and on April 16th on First Avenue between 116th and 125th Streets. Fulton Street had a granite block pavement, very dirty. On Mercer street the cleaner followed behind a sweeping machine and collected a heavy windrow thrown up by it which was wet with rain from the day before. Concerning the work performed in these downtown streets, the report turned in was: "Work performed excellent."

On Lenox Avenue and Fifth Avenue was sheet asphalt containing only fine dust and droppings, with litter in the gutter; the roadway width of the former is 80 feet and of the latter 40 feet. 31.9 miles of Lenox Avenue were covered in 6 hours and 20 minutes, 89,020 square yards being cleaned and 4½ cubic yards of material removed.

First Avenue was cleaned with the idea of noting the class of work the machine would do on very uneven and irregular granite block pavements. There was much litter and fine dust in the gutters and droppings on the roadway, which is 60 feet wide. At the same time the machine cleaned some side streets paved with asphalt. In 6 hours and 25 minutes actual time it traveled 22.8 miles, cleaning 73,046 square yards and collecting 7.12 cubic yards of material. All paper and heavy material were removed and the streets cleaned in an excellent manner.

Apparently the only material that was not thoroughly cleaned from the roadways was a thin layer of horse droppings which had been crushed on to the roadway by wheel traffic, and the tops of these were removed.

The following are the figures of operating cost per day as estimated by the Department: One



SIDE VIEW OF NEW YORK'S NEW STREET CLEANER.

END VIEW.

operator, $5.44; two quarts of oil, 17c; 16 gallons of gasoline, $2.88. Interest is figured at 5 per cent, $490; depreciation at 20 per cent, $1,960, and maintenance, $1,960; giving a total of fixed charges of $4,410. These average $12.08 a day on a basis of 365 days; but as days when the streets are covered with snow, very stormy days and other days off should be allowed for, we may assume 200 days a year, giving an average of $22.05 a day, giving a total of $30.54. A rate of 4 miles per hour would give about 90,000 square yards a day, giving an average cost of 34c per thousand square yards. The Department reports that hand-sweeping costs 44c.

The Manhattan machine is now working on West End Avenue between 72nd Street and 107th Street, paved with asphalt. When the writer observed this the other day it was making about 7 miles per hour, which, allowing for stops for emptying the cans, would probably give about 150,000 square yards a day, or an average of 20c per thousand square yards cleaned on the basis of 200 days a year.

Wilmington, N. C., Purification Plant

The new water purification plant of the city of Wilmington, N. C., was described in the September, 1923, issue of PUBLIC WORKS. It was put into service on April 20th, 1923, and a statement concerning its operation was given by George D. Norcom, sanitary engineer of the County Board of Health, before the North Carolina Section of the American Water Works Association and published in the July issue of the proceedings of that society. In this account Mr. Norcom says: "Physically they (the old supply and the new) are entirely opposite, the (old) one being highly colored with little turbidity and the other highly turbid with little color. In this difference lay the opportunity for increased economy, laboratory experiments indicating that the turbid water would require only about one-half as much alum as the colored. While the advantage of the mixing chamber and low velocity of basin flow was scarcely apparent on the colored water, it was very marked on the turbid water. With the colored water coagulation appears to be instantaneous and a good floc appears at once if optimum conditions are realized, but with the turbid water containing colloidal clay the benefit of the stirring action is apparent to the eye, it being possible to follow the progressive formation of the floc and subsequent clarification effected as the water passes through the mixing chamber. An important point in this connection is that the optimum for good coagulation is pH 4.4 with the colored water and pH 5.5 with the turbid water, while the pH range for good coagulation is much narrower with the former than with the latter. When the coagulated water passes through the diffusing well most of the floc settles quickly, as can be demonstrated when the basin is drained for cleaning. By utilizing various basin combinations it is possible to secure retention periods from two and four-fifths hours to twelve hours at the rate of 3 million gallons daily. The most advantageous retention period for the warm months seems to be about eight hours.

"The dry feeders for chemicals have proved greatly superior to the old solution feed. Stratification of alum solutions and clogging of lime orifices have been obviated. It is now possible to maintain a uniform feed and to regulate the dose according to the flow as indicated by the Venturi meter.

"The high velocity wash has already saved us a considerable amount of wash water and it is believed that it will overcome many of the difficulties formerly experienced from clogged underdrains and uneven application of wash water. The Simplex controllers have given complete satisfaction. The removal of bacteria by the filters equipped with the new sand has been uniformly efficient. . . .

"On chemicals the saving (in cost of treatment) effected is roughly as follows, in percentage: alum, 46; lime, 70; chlorine, 30. The saving in wash water is nearly 45 per cent. The cost of pumping is about the same for the low lift pumps, but there is a saving of almost $3.00 per million gallons on the pressure pumping due to reduction of personnel. The total saving on the filter plant amounts to $5.40 per million gallon or about $18.00 per day. The saving effected on the entire process is $8.14 per million gallons, $26 per day, or about $9,500 per annum."

Sand for Filters

In accordance with suggestions made by Edward E. Wall, water commissioner of St. Louis, C. M. Daily, the engineer in charge of the Supply and Purifying Section, for thirteen months conducted tests on eight filters of the city's plant, to determine the best size and depth to use in order to produce clear and wholesome water.

The method of making the tests is described in detail in the latest annual report of Commissioner Wall, and the conclusions drawn from a study of the tests are given as follows:

1st. Good water may be obtained with a 12″ bed of sand by sacrificing the length of run through the use of fine sand.

2nd. No sand finer than 0.38 m. m. is desirable in a filter bed.

3rd. Sand coarser than 1 m. m. does not appear to be of any value.

4th. It is doubtful if any advantage is secured by having greater depth than 24 inches of sand in a filter.

5th. Sand 24 inches deep, composed of

2″	depth	graded	from	.38 to .49 m. m.
6″	"	"	"	.49 to .62 m. m.
10″	"	"	"	.62 to .82 m. m.
6″	"	"	"	.82 to 1.00 m. m.

will give satisfactory results.

6th. Where sand grains become coated with calcium deposits, smaller sized grains should be used.

7th. The rate of filtration may influence the character of the effluent for any grading of sand.

8th. The effluent, after washing, was first clear, then became turbid and, after a period of 30 to 45 minutes running at ¼ rate, became clear and remained so even after raising the rate until the tests were concluded. After about three hours in service the best effluent was produced.

9th. Agar count in the effluent may not vary as the turbidity varies but it roughly follows the same changes.

10th. The character of aluminum hydroxide floc in the raw water will affect the character of the effluent. Zero turbidity is only approached and seldom reached.

The A. S. M. I. Convention

Papers and discussions before the thirtieth annual convention of the American Society for Municipal Improvements, held at Boston September 29th to October 2nd.

The convention was formally opened on the evening of Monday, September 29, with addresses of welcome, followed by reports of the officers and other business. A report of these will be found in this issue on the page devoted to "News of the Societies." Certain of the more interesting papers will be published in full or in abstract in this and following issues. A general summary of the papers and discussions is given in the following paragraphs:

TUESDAY'S SESSIONS

Street Paving Discussions

Tuesday morning's session opened with a report of the Committee on Street Paving and Street Design, the principal point brought out in which was the change, proposed by the granite block manufacturers, in the width of stone blocks to a block about an inch wider than the present standard, which suggestion was referred to the Committee on Specifications for Stone Block Pavements.

H. F. Harris described the construction of black base pavements in New Jersey, two of which have been described in PUBLIC WORKS. Of the others, one was constructed at night only, being open for traffic during the daytime, and was completed in two weeks. P. L. Brockway of Wichita, Kans., read a paper entitled "Street Crossings and Railway Tracks," in which he discussed several plans that have been tried for successfully solving the paving of such localities.

The construction of granite block streets with asphalt filler was described by T. E. Collins of Elizabeth, N. J. Mr. Collins preferred asphalt filler to grout. The blocks in Elizabeth were laid on a 3:1 sand-cement cushion. In the discussion, one member stated that he had used a 2:1 sand-cement cushion and that it had not set at all satisfactorily, but Mr. Collins reported that a 3:1 had been perfectly satisfactory in Elizabeth, while another member said that in Little Rock thousands of yards had been laid on such a cushion and, in cutting openings in the pavement afterwards, some of this cushion had come up in good-sized slabs.

"The development of Rubber Block Pavements" was the subject of a paper by Edgar S. Dorr, who described pavements laid with rubber block in this country and in England (see PUBLIC WORKS for January, 1924), and suggested that those interested visit the Northern Avenue bridge at Boston, the draw span of which had been paved with Wright rubber blocks at a cost of $12 to $13 per square yard. Rubber seemed to be especially suitable for draw spans because of its elasticity. It is also noiseless and not at all slippery. In addition to this type of block, Mr. Dorr also showed samples of the Herrick block, in which the rubber is cast with bottom lugs one-half inch deep which are pressed into the concrete base, on which blocks are laid while the concrete is still soft.

Clarence D. Pollock then presented a paper giving further information concerning the plan, advocated by him last year, of improving clay subgrades by placing on them a layer of coarse sand, cinders or gravel, thus preventing the raising of underground water by capillary attraction to the under side of the wearing surface of the pavement. In discussing this paper Lynn White stated that in the case of some Chicago clays with a high water content, 6 inches of cinders had been used and had prevented heaving which occurred when pavement was laid directly on the clay. A. W. Dow told of an instance in Chicago where the soil was a blue clay in which it was found that, while pavements on other streets were heaved, those on car track streets were not heaved, which difference he attributed to the effect of the trench dug for the underground trolleys, which served to drain out the clay. Leon F. Peck stated that he had changed the practice in Hartford from the use of sub-drains to the use of the porous layer and favored the latter. Others also discussed this paper and there were few if any adverse comments to the proposed method of treatment.

"Paving Design and Maintenance as Affected by Track Construction" was the title of a paper by Julius Adler, deputy chief of highways of Philadelphia. Mr. Adler expressed his preference for block pavement with asphalt mastic joints for paving between the rails.

The morning session closed with a paper by George F. Fisk discussing "Simplified Practice, What It Is and What It Offers to the Engineer." Special reference was made to the results obtained by the Federal committee in reducing the number of standard sizes of paving brick, with which the readers of PUBLIC WORKS are already familiar.

In the afternoon G. H. Perkins, vice-president of Warren Brothers Company, described "The Technique of Warren Pavement Construction," explaining the advantages claimed for the latest developments in Warrenite pavement whereby surface material and base were rolled together and effected a thorough bond.

One of the admirable features of the Convention was the general discussion of a number of questions which had been suggested in the program. The first of these was the question, "What Is the Best Method of Utilizing Old Granite Blocks in Constructing a New Pavement?" In opening the discussion, R. A. MacGregor stated that the three general methods available were crushing for broken stone, taking up and relaying, and recutting and relaying. Where recut blocks could be used this seemed to be the most economical. He had found

that by use of recut blocks, the area repaved by them would vary from 50 to 110 per cent. of the area from which they had been removed. Nathan L. Smith of Baltimore considered recutting the most economical use. He had laid recut blocks on a cement-sand bed with mastic filler, while those that were not good enough for redressing were used in alleys undressed. The largest and best shapes were redressed for liners along street railways. J. W. Howard told of having seen granite blocks used in this way thirteen years ago in Schenectady, each block in general being cut into four blocks about 4 inches deep; this pavement still being in good condition. W. W. Southgate described the method employed at Nashville, where the blocks were laid on a Telford macadam base with a 3-inch cushion and a tar mastic filler. A 1:3:5 mixture of cement, sand and cinders was used under the block and rolled before wetting, this concrete setting up after wetting in excellent condition. Pavement of recut blocks was laid by contract for about a dollar per yard less than the bid for a pavement using new blocks. Mr. Adler stated that in Philadelphia pavements of recut blocks were not quite so good as new, but were used as a matter of economy. As to fillers, he found that the mastic filler improves with age, while the grout filler deteriorates. Recut blocks were not satisfactory at street railway crossings, since, being smaller than the new blocks, they were more easily shaken out by the jarring of the cars. E. E. Butterfield of the Borough of Queens, New York, stated that old stone block pavements in that borough which had been improved by inserting oak wedges in the alternate courses were now five years old and were still in good condition.

Street Traffic

The next topic considered was, "What Can Be Done to Facilitate Traffic Movement by the Use of One-Way Streets or Through Streets?" The discussion was led by Prof. A. H. Blanchard, and was discussed by E. P. Goodrich, T. Chalkley Hatton, C. C. Brown, George A. Carpenter and others. The discussion was not confined at all closely to the immediate subject, but covered quite generally the subject of handling traffic in city streets. Prof. Blanchard stated that cities cannot afford to build costly pavements and allow them to be used for parking. Mr. Hatton stated that in Milwaukee traffic control signs were placed on the sides of the streets, one at each of the four corners of the intersection of two arterial highways. Mr. Brown stressed the need for uniformity of regulations, and Mr. Carpenter that for uniformity of signs.

The session closed with a paper by Monroe L. Patzig of Des Moines entitled, "Traffic Regulation," in which Mr. Patzig discussed the desirability of uniformity of traffic regulations.

Tuesday evening was spent in the rooms of the Boston City Club, where the Boston Society of Civil Engineers and the Northwestern Section of the American Society of Civil Engineers met in joint session with this Society. Harvey N. Shepard described Southern India, especially its temples, illustrating them by excellent pictures on the screen. This was followed by a three-reel film entitled "Power," in which the development of power from the earliest days to the largest turbo generators of to-day was illustrated by Stone & Webster, the latest development presented being the Weymouth plant of the Edison Electric Illuminating Company with an ultimate development of 400,000 horsepower, which that engineering firm is now constructing.

WEDNESDAY'S SESSIONS

City Planning and Traffic

E. A. Fisher read a brief report of the Committee on City Planning, introducing the papers on that subject.

The first of these was "City Planning Powers in Massachusetts," by Arthur C. Comey, director of Boston's Zoning Plan. He described the operation of the Massachesetts State Law which requires communities above a certain size to provide planning boards and stated that the system had worked well, even though some of the boards when appointed did not know what city planning was. Up to date seventy planning boards have been appointed in the state. They are advisory only and the cities employ various plans for enforcing city control of planning. In the discussion several members described the ordinances and operations relative to city planning in their cities. Mr. Fisher stated that in Rochester there could be no partition of property within the city limits unless approved by the Planning Commission. It was stated that at Youngstown, Ohio, many streets have been widened by mutual consent without any demand on the city for damages and the land being given for the purpose, and that property facing the widened streets increased in value in some cases $20 a foot due to the widening. Mr. Goodrich stated that in Los Angeles the city endeavored to enforce the city plan by refusing to supply water to properties on streets not laid out according to that plan. Mr. Fay stated that zoning and city planning in the city of Boston was under the control of the Legislature.

A paper entitled "Continuous City Planning," by Jacob L. Crane of Chicago, had been published in the advance papers and was read by title. A written discussion by L. L. Tribus was read by the Secretary, in which was outlined the history of the development of Staten Island.

E. P. Goodrich of New York City read an excellent paper on "Methods of Estimating Future Street Traffic." This included determination of future population growth; location of homes; the activities of the people in the various districts; the number of cars per foot frontage, per area of factory and other details of car ownership; the average distance traveled by each type of car, etc. The city would be divided into districts according to use and the traffic routes between the several districts that would probably be developed would be determined, and the ultimate amount of traffic that they would be called upon to carry. He recommended that a given city under consideration be divided into not less than 20 districts nor more than 100.

W. P. Blair commented on several of the city planning papers that they all dealt with wheel traffic but none of them considered the pedestrian, but the general opinion appeared to be that for the present the pedestrian must look out for himself. Professor Blanchard referred to the plan for carrying cross country routes around the congested districts of

cities rather than through them. Where a large amount of traffic passed around a certain corner a cutoff diagonally between the two intersecting streets might be warranted and the cost of it might even be paid for by the increased property values and the saving in time, gasoline, etc., to the automobiles. Mr. Fay gave as an illustration of the enormous growth of truck traffic the fact that many Connecticut factories are shipping typewriters, locks, etc., to New York City by trucks. Mr. Hatton raised the point that merchants object strongly to by-passing traffic around the streets on which their business is located, but others stated that in any but the smaller cities the congestion of through traffic so interfered with the local traffic from which the merchant obtained most of his business that merchants would unquestionably be benefited by detouring through traffic around the business districts.

Jefferson C. Grinnalds of Baltimore discussed "The Relation of Parks to Zoning." R. J. Hayden of Boston, in a paper entitled "Tree Planting Along Boulevards and Major Highways," gave detailed instructions for planting trees, named the kinds of trees most suitable, etc.

Street Lights and Signals

On Wednesday afternoon the delegates and their friends were taken on a trip around the city harbor on a steamer furnished by the city. From the steamer the delegates were taken to the plant of the General Electric Company at West Lynn, where there was displayed an exhibition of street lighting equipment, and papers on streets lights and signals were read and discussed.

Ralf Toensfeldt presented the report of the Committee on Street Lighting, followed by a paper, "The Latest Developments in Street Lighting," by S. C. Rogers, in which he referred especially to the large single units, using rippled glass globes, and to the use of reflectors and refractors for concentrating the light where wanted, both horizontally and vertically.

An automatic system of traffic control, both vehicular and foot, by use of electric lights in three colors, as developed by the General Electric Company for Meriden, Conn., was described by J. G. Regan, who asserted that the system was sufficiently flexible for use at any traffic intersection and gave perfect safety to pedestrians as well as to vehicles.

During these discussions members were taken in parties of twenty to see the electric illuminated fountain in Lynn, the construction of which had been described by P. A. Blackwell.

Discussion of street lighting brought out several views on the matter of payment therefor. Mr. Fisher cited one case where merchants who wished display lighting arranged to pay the cost of this in excess of the amount allotted for street lighting, the extra cost ranging from 10 cents to 35 cents per front foot per year.

THURSDAY'S SESSIONS

Sewerage and Refuse Disposal

In the absence of Langdon Pearse, chairman of the Committee on Sewage Disposal, this report was read by Mr. Hatton. He stated that the outstanding developments of the year in the line of sewage disposal was the study of the use of sludge, especially dewatering activated sludge. S. A. Greeley reported on "Garbage Disposal," the principal part of his report being a description of the new reduction plant at Michigan City, which will be published in PUBLIC WORKS.

A description by X. H. Goodnough of the "Merrimac Valley Trunk Sewer Project" was read by Edward Wright. Maps and profiles aided in showing the general nature of this ambitious project for cleaning up the Merrimac River by carrying the sewage from practically all of that section of it which lies in Massachusetts to an outlet into the ocean some distance off shore.

The new sewage treatment works at Worcester, Mass., were described by Ralph G. Lingley. They consist of Imhoff tanks, sprinkling filters, secondary tanks, and sludge beds, utilizing for the filters and beds some of the existing sand filters. Edward F. Murphy read a paper on the "Collection and Disposal of Municipal Wastes," which was followed by one entitled "The Effect of Industrial Wastes Upon Sewage Problems" by Langdon Pearse.

The question, "Is It Economical to Burn Garbage?" was presented for general discussion, Harrison P. Eddy and T. Chalkley Hatton being the leaders. Little was said in the discussion about the question of economy, but the discussion was largely one of the various features of garbage incineration.

In the discussion Kenneth Allen briefly described the incineration program undertaken by the city of New York, which has three incinerators in Queens, two in Richmond, one in Manhattan and one in Brooklyn. These are all doing good work and giving no offense. Another incinerator is about to be installed in Manhattan. There are land dumps in several of the boroughs and, there being more or less garbage mixed in with the rubbish and the combustible rubbish being burned on the dumps, there is more or less objectionable odor to these. He thought it a great pity that the Staten Island plant was put out of service for no evident reason except political pressure due to the aesthetic objections of the residents of the island to the plant.

Mr. Kingsley said that in Dallas ashes were collected by means of fourteen tractors, each with three trailers, at a cost of 80 to 85c. per ton for collection and care of the dumps. Mr. Macallum stated that his experience was that where alleys were available for use in collecting, the service could be performed at 40 per cent. less cost than where there were no alleys. In Canadian cities all the refuse is collected together. In Ottawa the cost is $1.16 per ton hauled an average of 2 miles to a dump, labor being paid 50c. an hour and the trucks having a capacity of 6 yards.

C. C. Brown described the plans for garbage disposal about to be adopted in Lakeland, Fla., where an incinerator is to be built alongside of a hog farm and the uneaten refuse from the latter, which constitutes about half of the garbage, will be burned in the incinerator, thus avoiding much of the odor that generally makes such farms objectionable. Kenneth Allen stated that at Blackwell's Island the garbage is dried and is used on the gardens. Drying, he said, was in process of development. Mr. Greeley believed that most plants failed to give satisfaction because they were not large enough for the peak load, as when the garbage was unusually wet. Sev-

eral cities spoke of the use of the "Bulldozer" operated in front of a caterpillar for levelling off dumps.

Contracts and Concrete

Thursday afternoon began with the report of the Committee on Municipal Contract Forms, W. W. Horner, chairman, which was chiefly one of progress, Mr. Horner presenting a paper by Sturgis H. Thorndike entitled "Systematic Form of Structural Contracts," which was discussed by Professor Allen. The Committee on Specifications for Bituminous Pavements reported tentative specifications for asphalt macadam pavement, which had been printed in the advance papers. In the discussion, elaboration of the specifications relative to pressure distribution was introduced, the principal features of which aimed to secure uniform distribution with no overlapping, and this was referred to the Committee with a view to introduction into the specifications.

E. E. Butterfield then presented papers on the "Examination of Concrete from a Structure and Methods for Determining the Quality of the Concrete," and on "Surface-treated Concrete Exposed to Sea Water and Sewage." In the former he described a method developed by the laboratory of the Borough of Queens, New York City, in which the concrete was sawed into a thin slab and the total area of the exposed aggregate was measured. In the latter paper he explained some experiments that are being made in testing the effect of sea water and sewage on concrete which had been subjected to different kinds of surface treatment. Following this he presented the report of the Committee on Specifications for Portland Cement Concrete Pavements, which had been under discussion with various representatives of the cement interests, engineers, etc., since the opening of the Convention. Several changes were recommended in the specifications as printed in the advance papers, most of them of minor importance.

The Committee on Stone Block Paving Specifications had no special recommendations to make except that the specifications provide for a block having a width of between 4½ and 5½ inches instead of a width of between 3½ and 4½ inches, as at present. The manufacturers stated that the cost of cutting the larger block would be little greater than the smaller, and that, therefore, the blocks could be sold at a lower price per square yard. With the joints reduced 7 per cent. or more in total length, the cost of joint material also would be reduced.

Water Supplies

George W. Fuller presented his report as chairman of the Committee on Waterworks and Water Supply, in which he noted an important Pennsylvania decision on stream pollution, the test by Rochester of iodine treatment of water, general activities in the waterworks field, the intention of the American Waterworks Association to issue a manual of waterworks practice, and the new Federal Government standard for quality of water. Alcide Chausse's report as chairman of the Committee on Public Safety was read in the absence of Mr. Chausse. This narrated what was being done in Canadian cities, special reference being made to fire, parking of automobiles, prevention of drowning accidents, etc.

The matter of the effort of the Standardization Committee to bring about a simplification of sizes of steel bars was brought to the notice of the Society and the approval of the Society was voted.

Street Cleaning and Maintenance

In the evening the report of the Committee on Street Maintenance and Street Cleaning and Snow Removal was presented by the chairman, A. Prescott Folwell, followed by a paper by W. J. Galligan on the "Motorization of the Chicago Street Department." In his report Mr. Folwell gave a brief summary of the methods and appliances employed by about 250 cities of the country in cleaning streets and removing snow. Mr. Galligan's paper contained exact figures concerning the work done and the cost thereof by scores of street-cleaning appliances used by the city of Chicago—reliable and definite figures such as had never before been given out by any city official, we believe. Mr. Galligan's paper will be published in PUBLIC WORKS.

The subject of "Backfilling of Trenches and Restoration of Street Surfaces" was discussed by S. Cameron Corson, who described the method used at Norristown, Pa., which has proved very satisfactory. This consists briefly in cutting back the earth for 6 inches or more beyond the side of the trench and for an equal amount below the bottom of the concrete base and throwing an arch of concrete across the trench underneath the base. This was followed by a general discussion on the question, "What Is the Best Method of Control of Street Openings and of Refilling and Repaving?" Mr. Folwell opened the discussion with a summary of the methods employed by 450 cities of various sizes. Methods employed by different cities were discussed at some length by T. Chalkley Hatton, Clarence D. Pollock, W. W. Horner, Leon F. Peck and John W. Hackney. Mr. Hackney described a thoroughly worked out system used in Atlantic City, N. J., of keeping track of the progress of operations in opening a trench, laying in it the sewer, water and gas connections and backfilling the same, all of which is done by the local contractors, following which the city department replaces the pavement.

Following the report of the Committee on Resolutions, a moving picture was shown of the operations of a Barber-Greene snow loader in loading snow onto trucks. Another moving picture entitled "The Romance of Clay" showed the manufacture of clay sewer pipe, from the mining of clay to the final laying of the pipe; while a film entitled "That Matter of Health," showed the use of clay in the form of sewers and bathroom and other sanitary appliances and the improvements that such use made in the health conditions of cities. The convention closed with a motion picture entitled "The Story of the Motor Truck," in which the General Motors Truck Company illustrated the various steps in the manufacture of a motor truck.

Recent Legal Decisions

EACH COUNTY IN MINNESOTA TO CONSTRUCT THE PORTION OF A JUDICIAL HIGHWAY WITHIN ITS LIMITS

The Minnesota Supreme Court holds, State v. District Court, Brown County, 195 N. W. 284, that Minnesota Laws 1921, c. 323, §41, as to the establishment of judicial highways, does not contemplate that one county shall contribute to the expense of constructing the portion of a judicial highway in another county. Each county is to construct the portion within its limits.

MUNICIPALITY'S DUTY TO INSPECT ITS ELECTRICAL PLANT

The Minnesota Supreme Court holds, Goar v. Village of Stephen, 196 N. W. 171, that a municipal corporation maintaining an electrical distributing plant owes to the public the duty of so inspecting and maintaining the plant as to prevent change and deterioration from natural causes resulting in a dangerous condition. Where injury occurs because of a defect which could have been prevented by inspection, and there is a total failure to inspect for 17 months, the municipal corporation is held to be negligent and liable accordingly.

EIGHT-HOUR DAY AND MINIMUM WAGE ORDINANCE HELD INVALID

The Michigan Supreme Court, Attorney General v. City of Detroit, 196 N. W. 391, holds that the Minimum Wage provision, tit. 9, c. 2, of the Detroit City Charter, requiring contractors doing work for the city to observe an eight-hour day and a minimum wage rate, and an ordinance in pursuance thereof, are ultra vires, as attempting to exercise police powers over matters of state concern and to fix a public policy for other than purely local activities.

PARTY FURNISHING GRAVEL TO CONTRACTOR CANNOT SUE THEREFOR THIRD PERSON AGREEING TO LEND CONTRACTOR MONEY

The Circuit Court of Appeals, Fifth Circuit, holds, Grand Prairie Gravel Co. v. Trinity Portland Cement Co., 295 Fed. 140, that a mere showing that a cement company agreed to lend money to a contractor to enable him to carry out his contracts for paving, knowing that the contractor was purchasing gravel from a third party, did not render the contractor liable to action by such third person for gravel furnished to the contractor.

PERCENTAGE TAX BY CITY ON GOODS SOLD IN INTERSTATE COMMERCE UNCONSTITUTIONAL

The Circuit Court of Appeals, Eighth Circuit, holds, American Mfg. Co. v. City of St. Louis, 296 Fed. 899, that the commerce clause of the United States Constitution forbids a state or a municipal corporation therein from levying a tax on the business of selling goods in interstate commerce, measured by a percentage of the gross transactions in such commerce, because such a tax is a direct burden on and regulation of such commerce, as it withholds from every transaction, for the use of the state, of a part of every dollar received.

NOTICE TO CONTRACTOR BEFORE TAKING OVER AND COMPLETING WORK

In exercising the right to take over and complete unfinished work at the expense of the contractor, the owner must comply with the conditions precedent provided for in the contract, and where a road construction contract provided for three days' notice that the work was being unnecessarily delayed, and the county ignored this provision and peremptorily discharged the contractor, the Virginia Supreme Court of Appeals held, Jones v. Nelson County, 120 S. E. 140, that, in the absence of waiver of the provision by the contractor, the county had voluntarily divided what otherwise would have been an entire and indivisible contract, and entitled the contractor to payment for labor and material furnished by him.

AMOUNT OF LIEN FOR CONSTRUCTION OF SIDEWALK

The Kentucky Court of Appeals holds, City of Uniontown v. Chapman, 255 S. W. 118, that under Ky. St. §§ 3643, 3647, a city of the fifth class is not precluded from constructing a sidewalk at a cost exceeding $100 without letting the contract by public bidding, on the failure of the property owners to do so. However, in undertaking this character of work, it should exercise care and diligence in its prosecution. It is not authorized to act arbitrarily, either by doing such work at unsuitable periods, or at exorbitant cost, and will only be allowed a lien for an amount calculated at the prevailing rate for such work at the time it was done.

NECESSITY FOR STATE COMPTROLLER'S APPROVAL OF HIGHWAY CONTRACT

The New York Court of Claims holds, Colarusso v. State, 122 Misc. 191, 202 N. Y. Supp. 510, that there can be no recovery on a highway contract for work done prior to the comptroller's approval of the contract, on the theory of breach of contract where the contractor, on learning that the contract has not been approved, stops work and claims damages; but that the subsequent execution of the contract will be a ratification of the contractor's acts and an acceptance of the work done by him, where that work had been done under the supervision of the commissioner of highways without informing him that the contract had not been approved.

CONTRACT PROVISION AGAINST RECOVERY FOR DELAY CAUSED BY STATE

A provision in a contract for public works that "no charges shall be made by the contractor

for any delays or hindrances for any cause during the progress of any portion of the work" and that delay caused by the state's authorities or other contractors would entitle the contractor to an extension of time for completion, was held by the New York Court of Claims, Mack v. State, 122 Misc. (N. Y.) 344, 202 N. Y. Supp. 344, to be a bar to recovery of damages resulting from the state's delay in getting its buildings ready for the installation of electrical work contracted for, and under the express terms of the provision the reasonableness or unreasonableness of the delay was immaterial, there being no active interference by the state with the work being done.

CITY'S RIGHT TO AUTHORIZE USE OF STREET FOR LIGHT AND POWER TOWERS

The West Virginia Supreme Court of Appeals holds, Karcher v. Wheeling Electrical Co., 118 S. E. 154, that the use of the streets of a municipality by an electric light and power company, furnishing light and power to the public and for private use, by placing steel towers therein, on which are strung its transmission lines carrying high voltage electricity, authorized by proper municipal franchise, is not an additional servitude on the easement of the street for which an abutting owner can, ipso facto, recover damages against the licensee or the municipality. The use of the street for that purpose is not limited to the centre of the street. Any portion thereof may be used which the municipal authorities may prescribe, with due regard to public safety.

SUFFICIENT CERTAINTY OF PAVING SPECIFICATIONS

The Mississippi Supreme Court holds, Robertson v. Southern Bitulithic Co., 97 So. 482, that supervisors of a county are given considerable discretion in the exercise of the functions of their office; and where they and expert engineers consider the specifications of a highway contract as understandable and definite, and act on them in good faith, and the contract is satisfactorily performed without deception or fraud, the act of the board in approving, accepting and paying for the work should not be disturbed by the court on the ground that the specifications were not sufficiently definite.

COUNTY AUTHORITIES IN SOUTH CAROLINA CANNOT AUTHORIZE CONSTRUCTION OF PRIVATE TELEPHONE LINE ALONG HIGHWAY

The South Carolina Supreme Court holds, Benton v. Yarborough, 123 S. E. 204, that a private individual has no right, in that state, to construct, by permission of the county authorities, a telephone line for its own private use along the line of a public highway over the protest of the owner of the fee in the soil upon which such highway is located, in view of the 14th Amendment to the federal Constitution, the state Constitution, and the state statue of 1923 conferring the power of condemnation with compensation upon telegraph and telephone companies, quasi public corporations. The question of the power of the legislature to confer the right without compensation was not considered.

FORFEITURE OF DEPOSIT WITH BID ON HIGHWAY CONTRACT

The Mississippi Supreme Court holds, Jackson County v. Galloway & Bonnabel, 96 So. 106, that where a bidder on a federal-aid highway contract, who was required and did deposit a certified check as guaranty that, if awarded the contract, it would execute the contract and give bond within 10 days after notice of award of contract, knew that the federal authorities had not approved the plans, this fact did not relieve it of the requirement to file the bond within the time agreed or excuse delay the real reason of which was difficulty in securing sufficient sureties.

At the end of the 10 days the board of supervisors made an order that the contractor file the bond forthwith. It is held that, if this order amounted to an extension for a reasonable time, more than 10 days additional was not reasonable, and a bond filed thereafter was properly rejected. The county thereafter relet the contract at a loss exceeding the deposit. It is held that the county was within its rights in declaring a forfeiture of the deposit, the bidder having agreed that the check might be forfeited as liquidated damages upon failure to execute the contract and furnish bond within 10 days after award.

DAMAGES ARISING FROM SPECIFIC REPAIRS ON STREETS—MASSACHUSETTS STATUTE

In an action in the Massachusetts courts for damages to an abutting owner's premises and business by change of grade of a street, the question arose whether the order of the city council establishing a new grade and providing for the repavement of the street in conformity thereto was a specific or a general repair. The Massachusetts Supreme Judicial Court holds, L'Huilier v. City of Fitchburg, 141 N. E. 122, that when changes are made in the grade of a public way by an authority competent to fix the grade, which specifically declares the nature and extent of the changes in the record of its proceedings, repairs made accordingly within a reasonable time thereafter are specific repairs. General or ordinary repairs are those made or ordered either by an officer or board not authorized to establish the legal grade, or which is authorized to establish such grade but without specifically determining by its order the nature and extent of the change to be made, although occasionally, even in this class of orders for repairs, radical and important changes not merely incidental to reconstruction may stamp the repair as specific rather than general or ordinary.

Under these principles an order by a municipal board having authority to establish the legal grade, which, as a part of the record of its proceedings changes substantially the grade and prescribes considerable modification as to construction and resurfacing of the street is one for specific repairs, and the case is governed by the statute of 1917, c. 344, pt. 2, § 28, requiring a petition for the assessment of damages arising from specific repairs to be filed within a year from the commencement of the work.